

SCORE Placeholder Sheet for IFW Content

Application Number: 16733888

Document Date: 01/03/2020

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- Drawing

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UTILITY PATENT APPLICATION TRANSMITTAL <i>(Only for new nonprovisional applications under 37 CFR 1.53(b))</i>	Attorney Docket No.	474139US02
	First Named Inventor	Takeshi Okazaki
	Title	Platform, Systems, and Methods for Identifying Property Characteristics and Property
	Priority Mail Express® Label No.	

APPLICATION ELEMENTS <i>See MPEP chapter 600 concerning utility patent application contents.</i>	Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450
1. ☐ Fee Transmittal Form (PTO/SB/17 or equivalent) 2. ☐ Applicant asserts small entity status. See 37 CFR 1.27 3. ☐ Applicant certifies micro entity status. See 37 CFR 1.29. Applicant must attach form PTO/SB/15A or B or equivalent. 4. ☒ Specification [Total Pages <u>51</u>] Both the claims and abstract must start on a new page. (See MPEP § 608.01(a) for information on the preferred arrangement) 5. ☒ Drawing(s) (35 U.S.C. 113) [Total Sheets <u>15</u>] 6. Inventor's Oath or Declaration [Total Pages <u>2</u>] (including substitute statements under 37 CFR 1.64 and assignments serving as an oath or declaration under 37 CFR 1.63(e)) a. ☐ Newly executed (original or copy) b. ☒ A copy from a prior application (37 CFR 1.63(d)) 7. ☒ Application Data Sheet * See note below. See 37 CFR 1.76 (PTO/AIA/14 or equivalent) 8. CD-ROM or CD-R in duplicate, large table, or Computer Program (Appendix) ☐ Landscape Table on CD 9. Nucleotide and/or Amino Acid Sequence Submission (if applicable, items a. – c. are required) a. ☐ Computer Readable Form (CRF) b. ☐ Specification Sequence Listing on: i. ☐ CD-ROM or CD-R (2 copies); or ii. ☐ Paper c. ☐ Statements verifying identity of above copies	ACCOMPANYING APPLICATION PAPERS 10. ☐ Assignment Papers (cover sheet & document(s)) Name of Assignee _____ 11. ☐ 37 CFR 3.73(c) Statement ☐ Power of Attorney (when there is an assignee) 12. ☐ English Translation Document (if applicable) 13. ☒ Information Disclosure Statement (PTO/SB/08 or PTO-1449) ☐ Copies of citations attached 14. ☐ Preliminary Amendment 15. ☐ Return Receipt Postcard (MPEP § 503) (Should be specifically itemized) 16. ☐ Certified Copy of Priority Document(s) (if foreign priority is claimed) 17. ☐ Nonpublication Request Under 35 U.S.C. 122(b)(2)(B)(i). Applicant must attach form PTO/SB/35 or equivalent. 18. ☒ Other: Certification and Request for Prioritized Examination _____ _____ _____ _____

***Note:** (1) Benefit claims under 37 CFR 1.78 and foreign priority claims under 1.55 **must** be included in an Application Data Sheet (ADS).
(2) For applications filed under 35 U.S.C. 111, the application must contain an ADS specifying the applicant if the applicant is an assignee, person to whom the inventor is under an obligation to assign, or person who otherwise shows sufficient proprietary interest in the matter. See 37 CFR 1.46(b).

19. CORRESPONDENCE ADDRESS					
☒ The address associated with Customer Number: <u>146018</u> OR ☐ Correspondence address below					
Name					
Address					
City	State	Zip Code			
Country	Telephone	Email			
Signature	/Natalie J. Grace/			Date	January 3, 2020
Name (Print/Type)	Natalie J. Grace			Registration No. (Attorney/Agent)	65,803

This collection of information is required by 37 CFR 1.53(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

Privacy Act Statement

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

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

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

Electronic Patent Application Fee Transmittal				
Application Number:				
Filing Date:				
Title of Invention:		Platform, Systems, and Methods for Identifying Property Characteristics and Property Feature Conditions Through Aerial Imagery Analysis		
First Named Inventor/Applicant Name:		Takeshi Okazaki		
Filer:		Natalie J. Grace/Jon Bhatt		
Attorney Docket Number:		474139US02		
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:				
CLAIMS IN EXCESS OF 20	1202	2	100	200
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 (\$)				6060

Electronic Acknowledgement Receipt	
EFS ID:	38199380
Application Number:	16733888
International Application Number:	
Confirmation Number:	5317
Title of Invention:	Platform, Systems, and Methods for Identifying Property Characteristics and Property Feature Conditions Through Aerial Imagery Analysis
First Named Inventor/Applicant Name:	Takeshi Okazaki
Customer Number:	146018
Filer:	Natalie J. Grace/Jon Bhatt
Filer Authorized By:	Natalie J. Grace
Attorney Docket Number:	474139US02
Receipt Date:	03-JAN-2020
Filing Date:	
Time Stamp:	16:02:04
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$ 6060
RAM confirmation Number	E202013G02438571
Deposit Account	601484
Authorized User	Jon Bhatt
<p>The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:</p> <p>37 CFR 1.16 (National application filing, search, and examination fees)</p> <p>37 CFR 1.17 (Patent application and reexamination processing fees)</p>	

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	Application Data Sheet	474139US02_ADS.pdf	1256129	no	8
			6751378d0614e23a167c399b7157d42af2e2bd97		
Warnings:					
Information:					
2	Drawings-only black and white line drawings	474139US02_Drawings.pdf	2021628	no	15
			85abb1da431a8353882c4f57561a594b6b9732ed		
Warnings:					
Information:					
3	Oath or Declaration filed	474139US02_ExecutedDeclaration.pdf	324710	no	2
			3ace94f2d829776c890e38c0e0814ac5f67dc22		
Warnings:					
Information:					
4	Information Disclosure Statement (IDS) Form (SB08)	474139US02_IDSform1.pdf	1037505	no	13
			3b26787e3067901303cc96d45c62fb2410b17650		
Warnings:					
Information:					
5	Information Disclosure Statement (IDS) Form (SB08)	474139US02_IDSform2.pdf	1034611	no	5
			25641a886914b20734d741439f766605a5e7196f		
Warnings:					
Information:					
6		474139US02_Specification.pdf	344482	yes	51
			a0a0dbab47e27e246c952d7a668379214ed8fcb3		
	Multipart Description/PDF files in .zip description				
	Document Description	Start	End		

	Specification		1	44	
	Claims		45	50	
	Abstract		51	51	
Warnings:					
Information:					
7	TrackOne Request	474139US02_TrackOneRequest.pdf	114608	no	2
			de54f951827413c2f660298e57c126d268ba923f		
Warnings:					
Information:					
8	Transmittal of New Application	474139US02_UtilTransmittal.pdf	280466	no	2
			495258d76ef562ec4cc68fede0f05893c2cad674		
Warnings:					
Information:					
9	Non Patent Literature	NPL1_15714376_CTNE_2019-03-21.pdf	334477	no	9
			b8e299dfc90e28e3c95307f80fb25171381bfc13		
Warnings:					
Information:					
10	Non Patent Literature	NPL2_15714376_NOA_1.pdf	543850	no	10
			6f0b5f999bc0c36694260bc5c950343faa72329a		
Warnings:					
Information:					
11	Non Patent Literature	NPL3_15714376_NOA_2.pdf	543427	no	10
			031871b31489b885249e66b0898f0dc55df97f9d		
Warnings:					
Information:					
12	Fee Worksheet (SB06)	fee-info.pdf	42039	no	2
			f0db105e39f771f8679cf6b31270cd6d8a1dece8		
Warnings:					
Information:					

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	474139US02
		Application Number	
Title of Invention	Platform, Systems, and Methods for Identifying Property Characteristics and Property Feature Conditions Through Aerial Imagery Analysis		
<p>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.</p>			

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	
	Takeshi		Okazaki		
Residence Information (Select One) US Residency • Non US Residency Active US Military Service					
City	Tokyo	Country of Residence ⁱ	JP		
Mailing Address of Inventor:					
Address 1	Capitol Tower 11F, 2-10-3				
Address 2	Nagatacho, Chiyoda-ku				
City	Tokyo	State/Province			
Postal Code	100-0014	Country ⁱ	JP		
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	146018		
Email Address	info@gardellagrace.com	Add Email	Remove Email

Application Information:

Title of the Invention	Platform, Systems, and Methods for Identifying Property Characteristics and Property Feature Conditions Through Aerial Imagery Analysis		
Attorney Docket Number	474139US02	Small Entity Status Claimed	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	15	Suggested Figure for Publication (if any)	

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	474139US02
		Application Number	
Title of Invention	Platform, Systems, and Methods for Identifying Property Characteristics and Property Feature Conditions Through Aerial Imagery Analysis		

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	146018		

Domestic Benefit/National Stage Information:

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

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

Prior Application Status	Pending	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	Continuation in part of	15714376	2017-09-25

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	474139US02
		Application Number	
Title of Invention	Platform, Systems, and Methods for Identifying Property Characteristics and Property Feature Conditions Through Aerial Imagery Analysis		
Prior Application Status	Expired	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15714376	Claims benefit of provisional	62398665	2016-09-23
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).

Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Access Code ⁱ (if applicable)	Remove
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

<p>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.</p> <p>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.</p>

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	474139US02
		Application Number	
Title of Invention	Platform, Systems, and Methods for Identifying Property Characteristics and Property Feature Conditions Through Aerial Imagery Analysis		

Authorization or Opt-Out of Authorization to Permit Access:

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

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

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

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

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

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

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

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

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

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

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

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

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	474139US02
		Application Number	
Title of Invention	Platform, Systems, and Methods for Identifying Property Characteristics and Property Feature Conditions Through Aerial Imagery Analysis		

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		<input type="button" value="Remove"/>	
<p>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.</p>			
		<input type="button" value="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:			
<div style="border: 1px solid black; height: 20px; width: 100%;"></div>			
Name of the Deceased or Legally Incapacitated Inventor: <div style="border: 1px solid black; width: 400px; height: 20px;"></div>			
If the Applicant is an Organization check here. ☒			
Organization Name	Aon Benfield Inc.		
Mailing Address Information For Applicant:			
Address 1	200 E. Randolph Street		
Address 2			
City	Chicago	State/Province	IL
Country	US	Postal Code	60601
Phone Number		Fax Number	
Email Address			
Additional Applicant Data may be generated within this form by selecting the Add button. <input type="button" value="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.

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	474139US02
		Application Number	
Title of Invention	Platform, Systems, and Methods for Identifying Property Characteristics and Property Feature Conditions Through Aerial Imagery Analysis		

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. ☒			
Organization Name	Aon Benfield Inc.		
Mailing Address Information For Assignee including Non-Applicant Assignee:			
Address 1	200 E. Randolph Street		
Address 2			
City	Chicago	State/Province	IL
Country ⁱ	US	Postal Code	60601
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:[Remove](#)

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	/Natalie J. Grace/		Date (YYYY-MM-DD)	2020-01-03	
First Name	Natalie	Last Name	Grace	Registration Number	65803
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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	474139US02
		Application Number	
Title of Invention	Platform, Systems, and Methods for Identifying Property Characteristics and Property Feature Conditions Through Aerial Imagery Analysis		

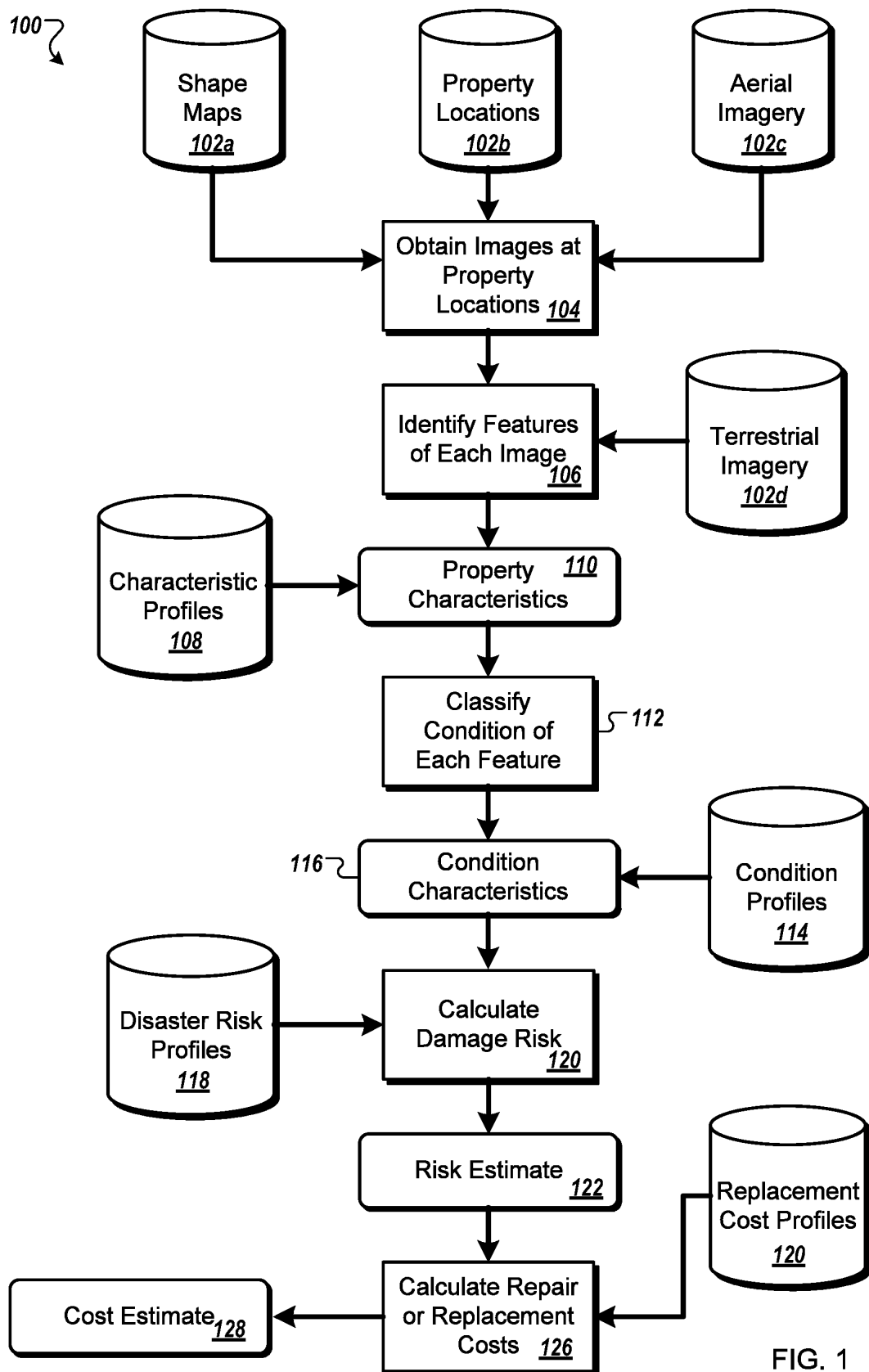
This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes 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.**

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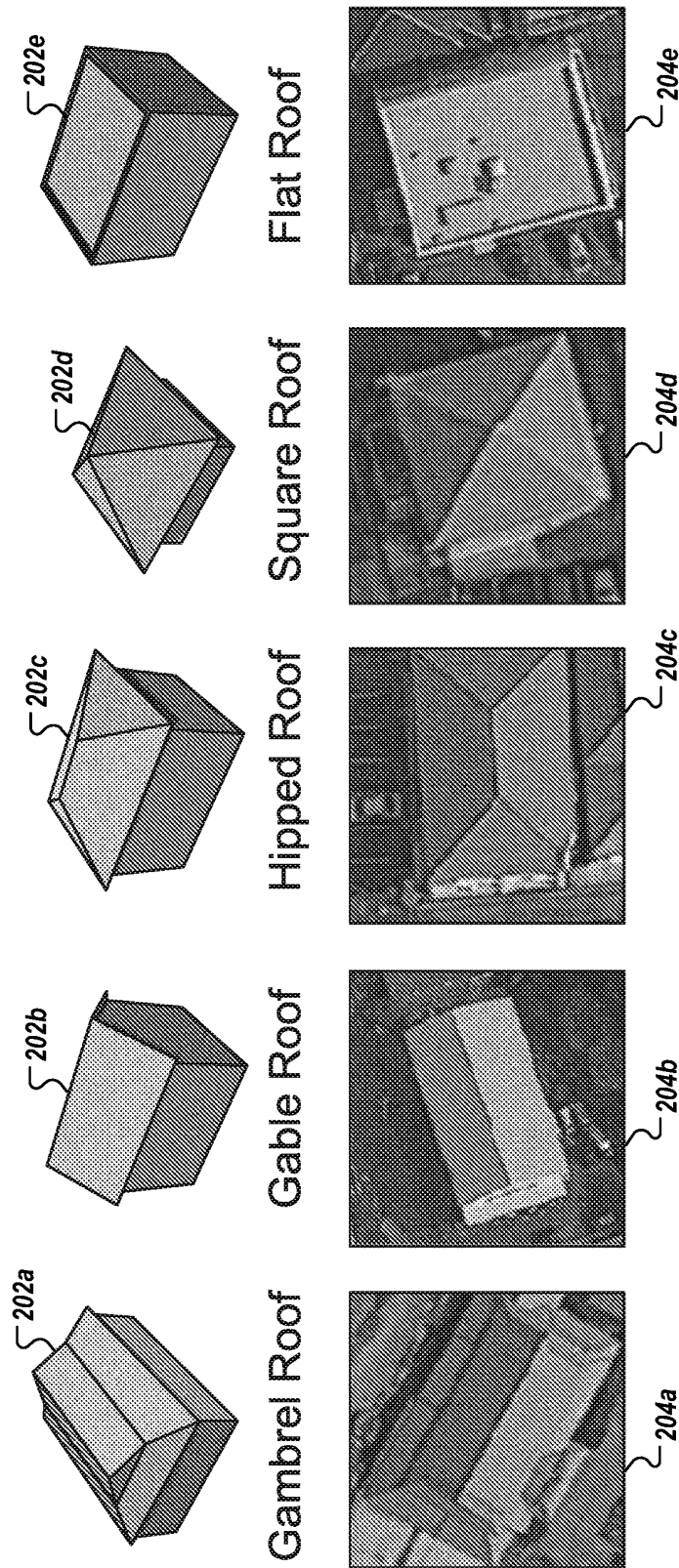
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The information provided by you in this form will be subject to the following routine uses:

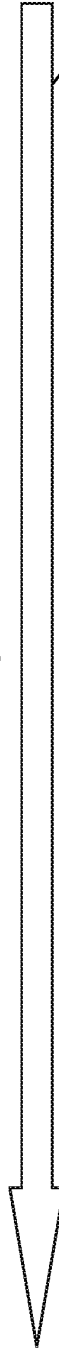
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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.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



Example Characteristic Classifications: Roof Type



More Vulnerable to Strong Wind



Example Risk Profile based on Roof Type

FIG. 2A

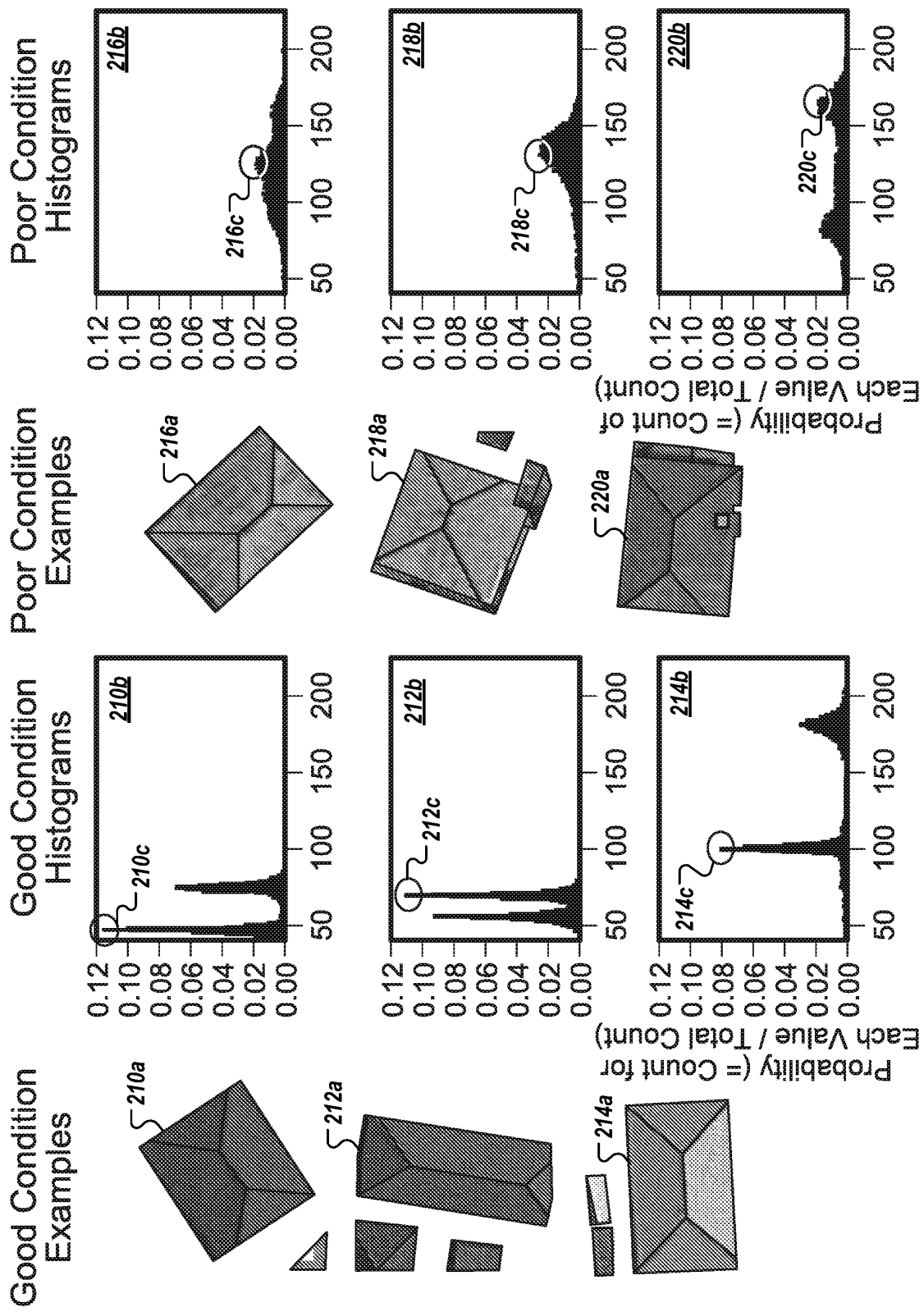


FIG. 2B

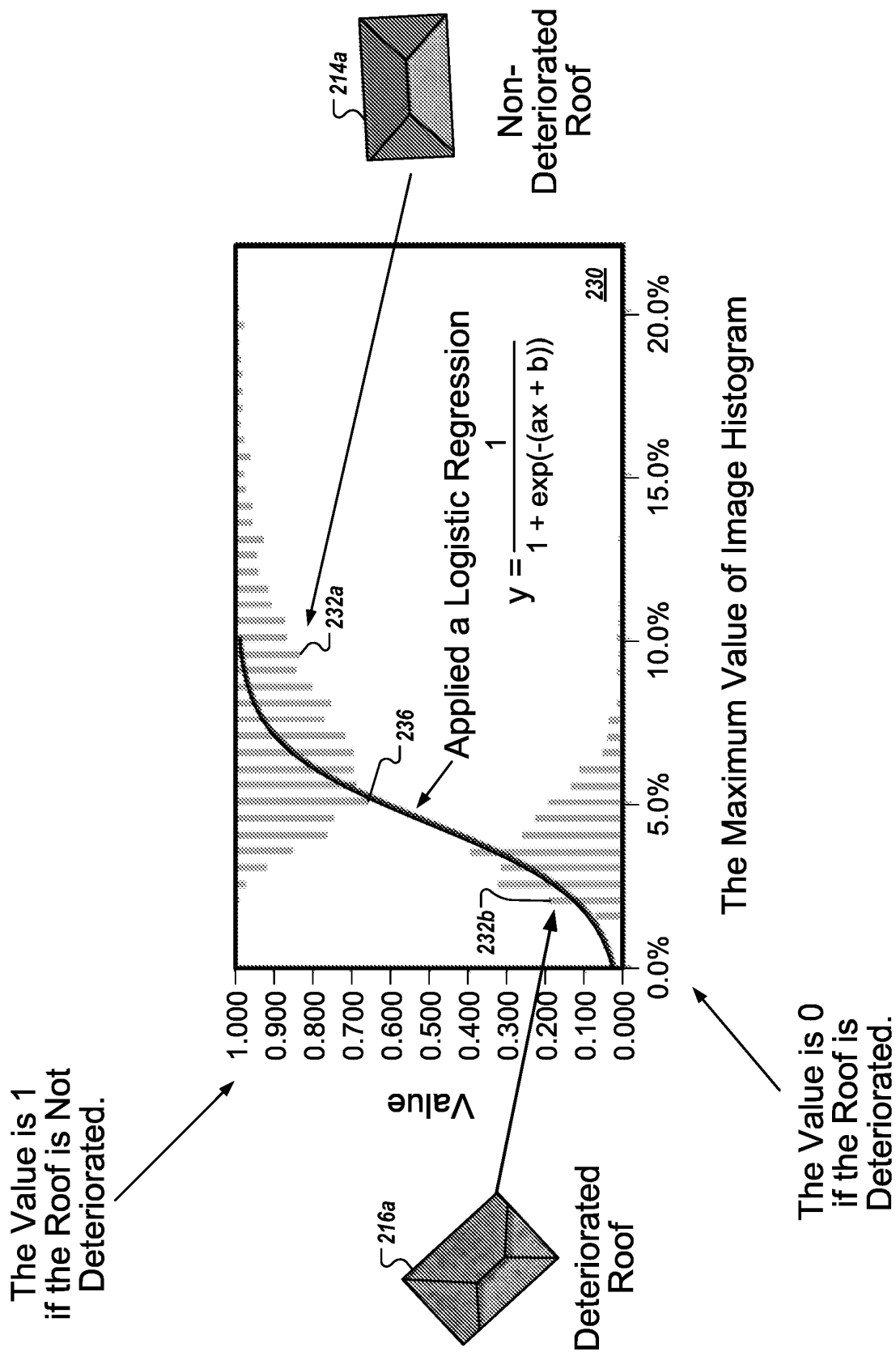


FIG. 2C

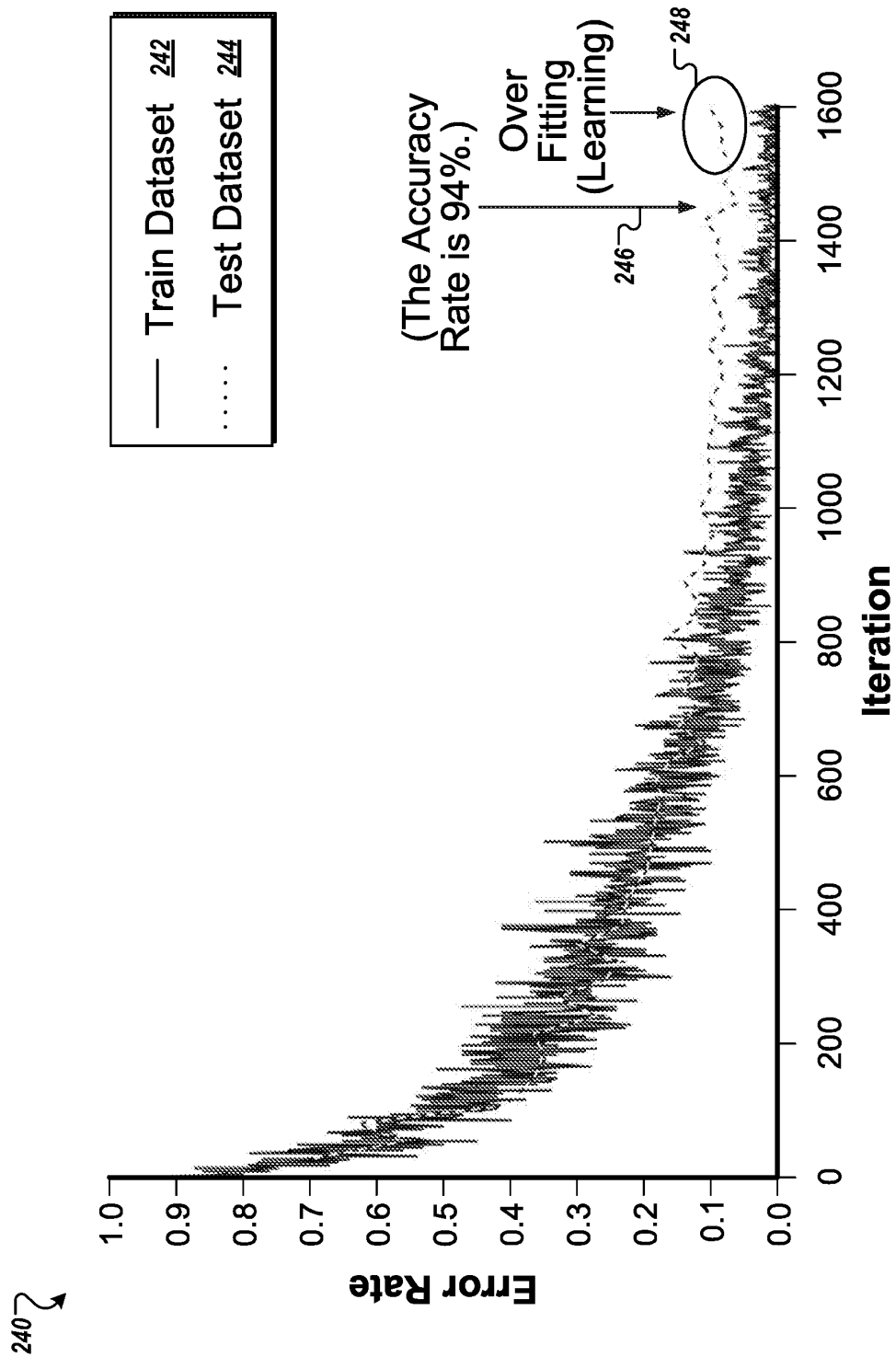


FIG. 2D

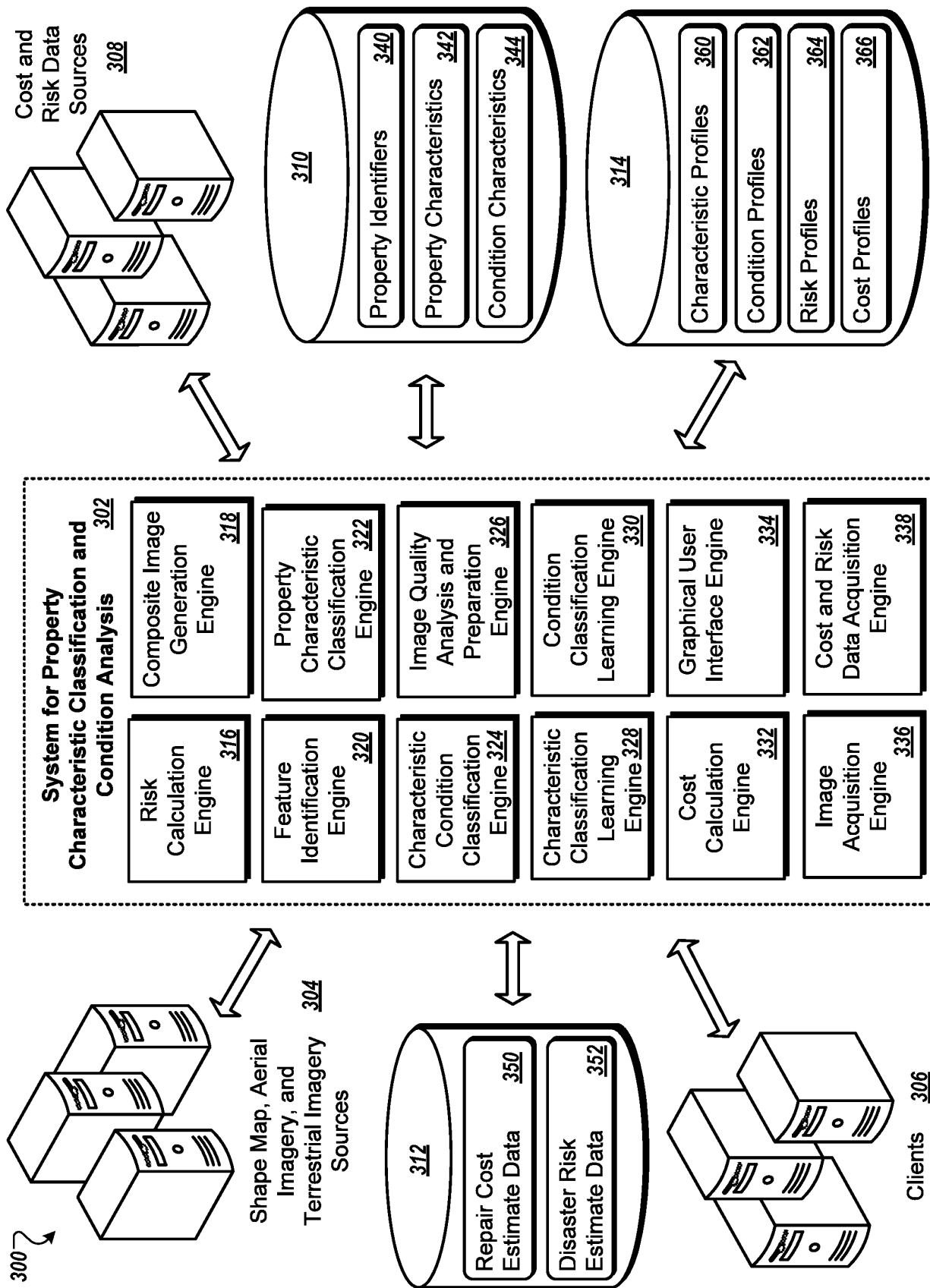


FIG. 3

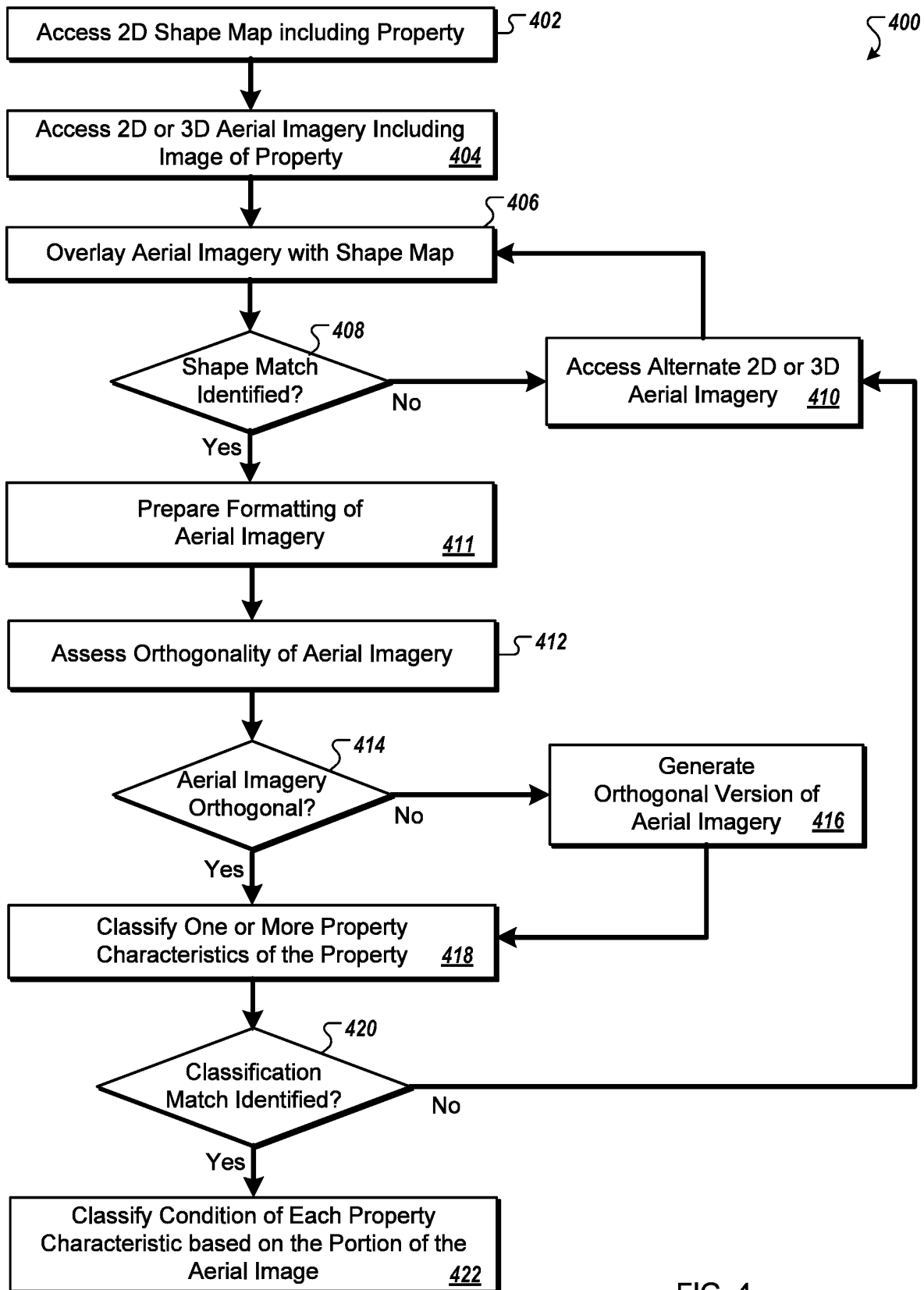


FIG. 4

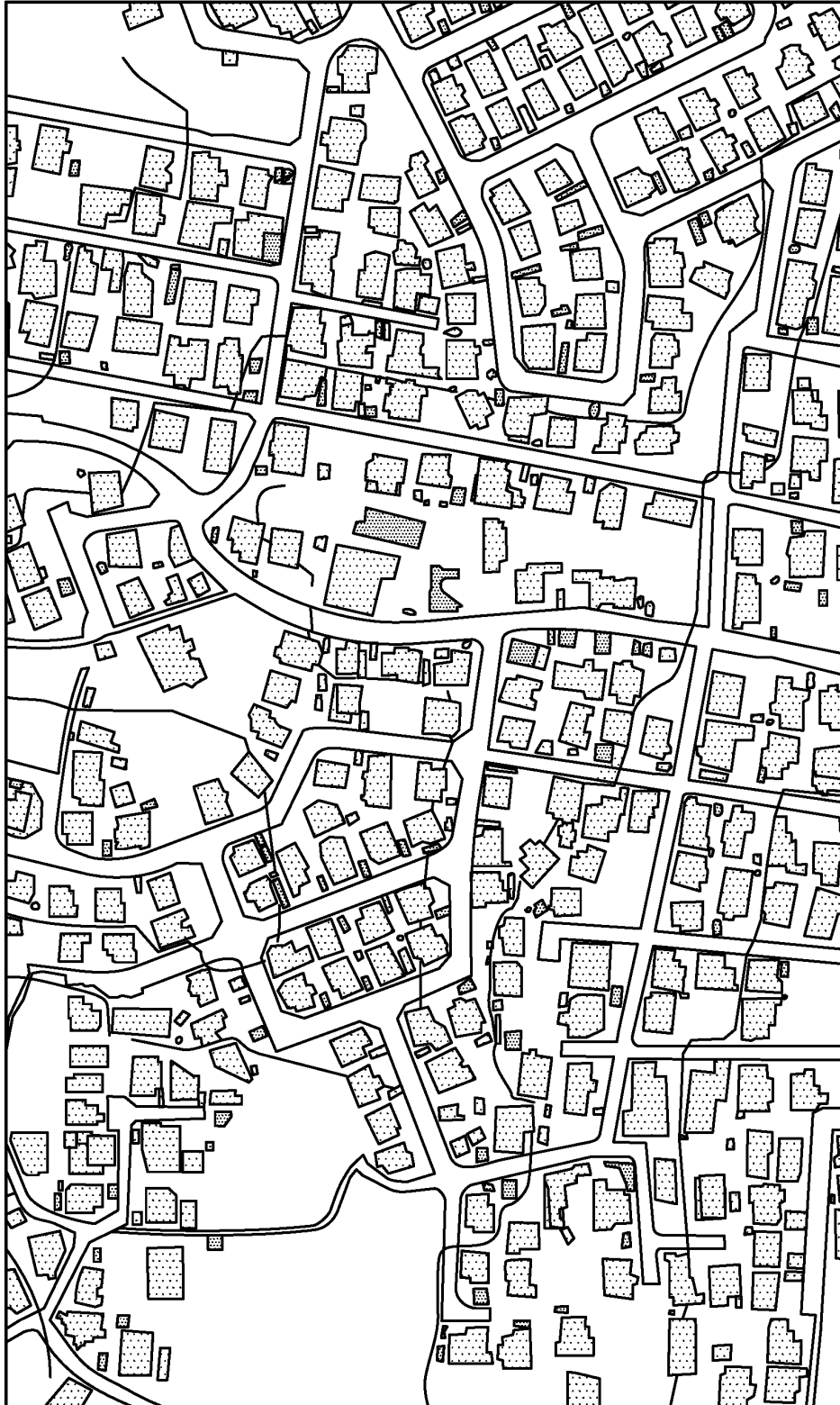


FIG. 5A

510 ↗



FIG. 5B

520

524



522

FIG. 5C

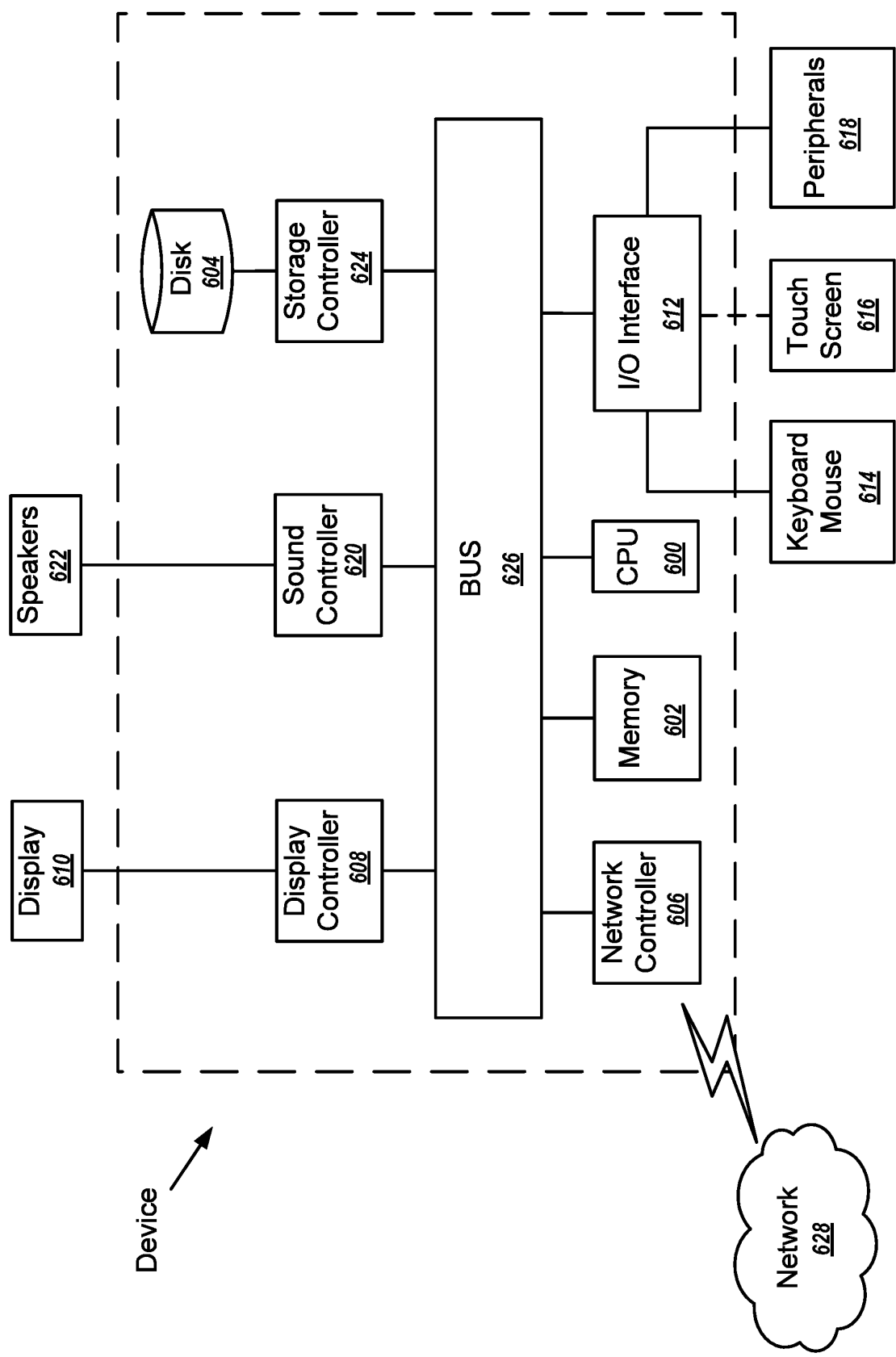


FIG. 6

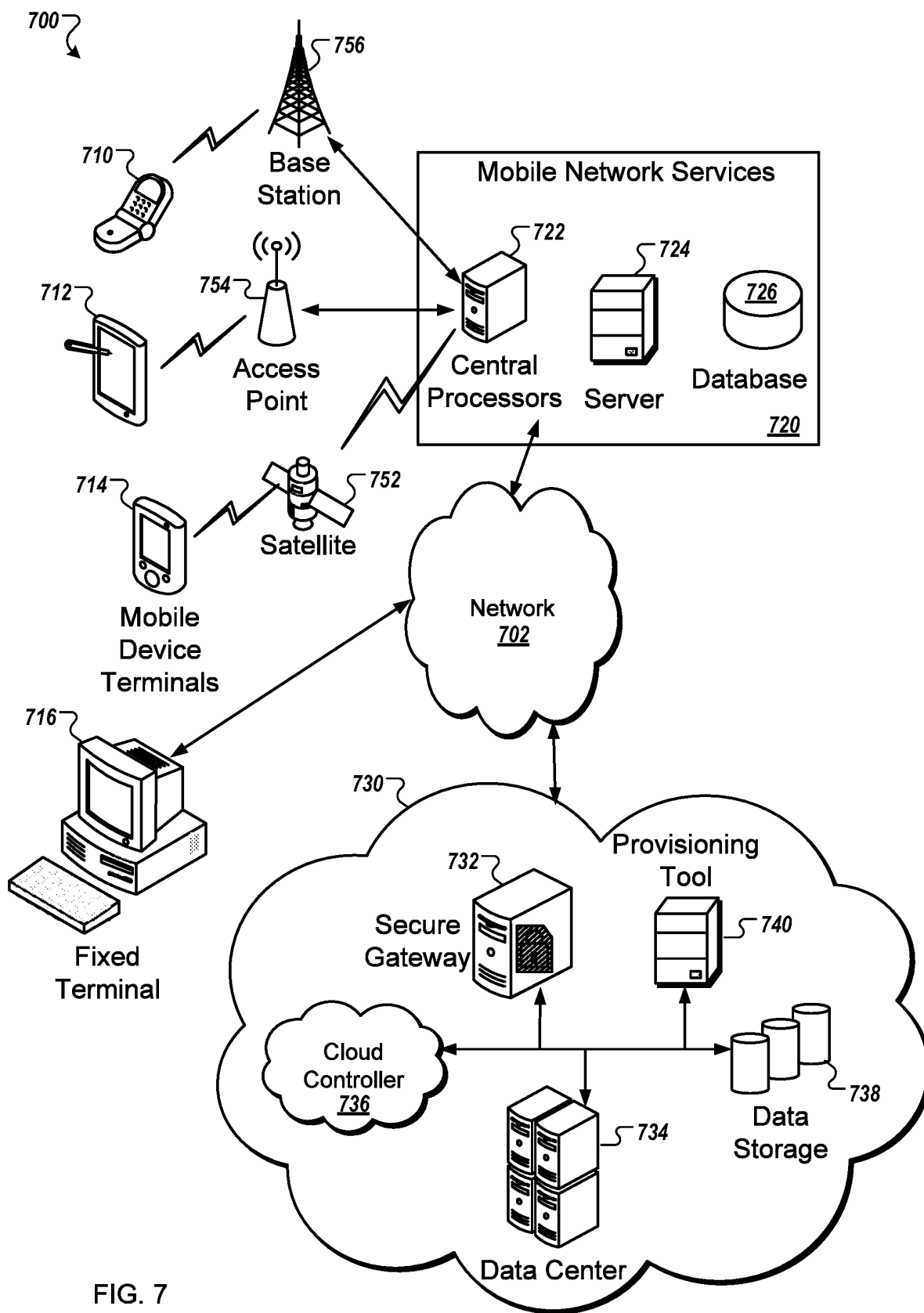


FIG. 7

800

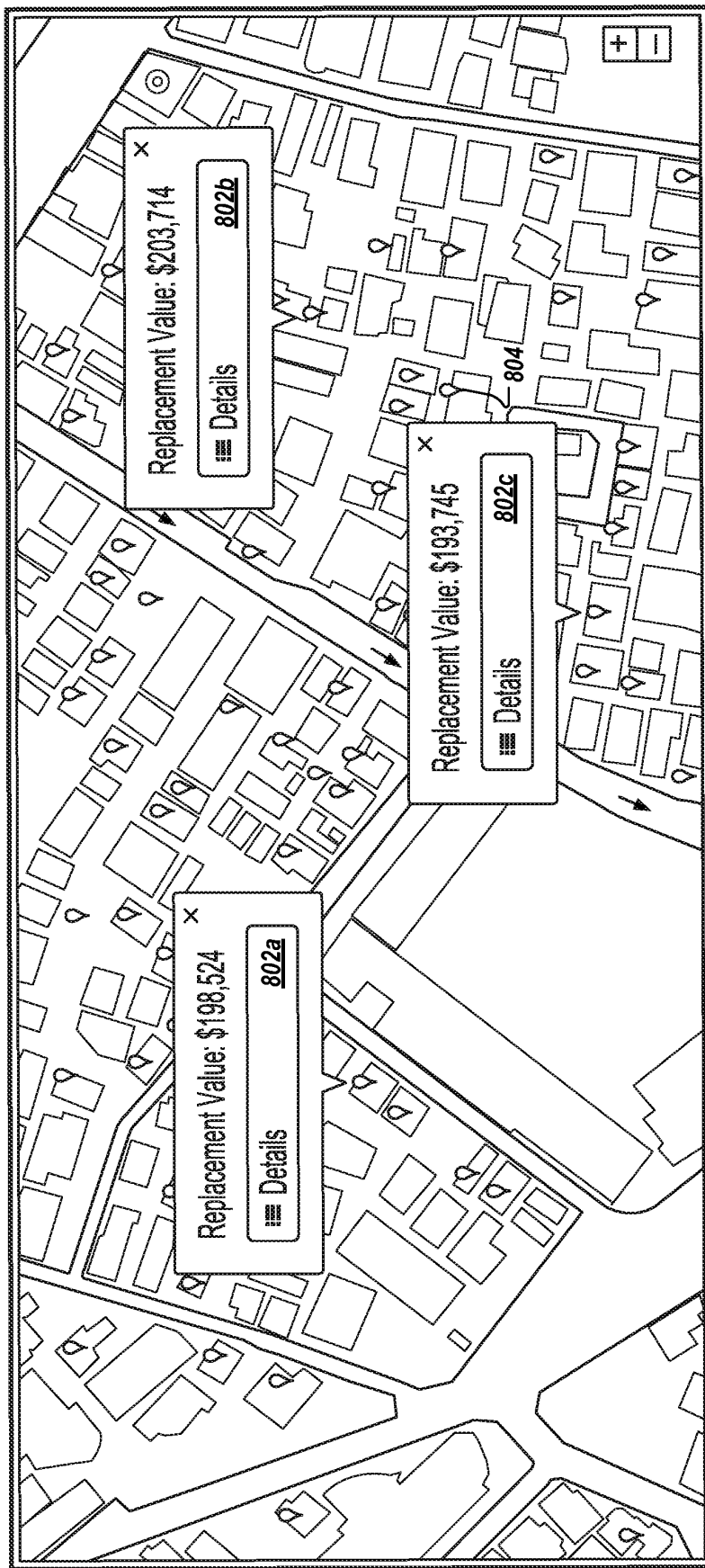


FIG. 8A

820

Bld Area	 Edit	 828a
Bld Area	63m ²	<u>822a</u>
Stories	2	<u>822b</u>
Total Bld Area	127m ²	<u>822c</u>
Structure	 Edit	 828b
Structure	Wooden	<u>824a</u>
Construction Class	Grade H	<u>824b</u>
Premium	 Edit	 828c
Replacement Value, USD	\$203,714	<u>826</u>

FIG. 8B

840 ↗

Disaster Risk		
842a ↗		Level: 4~5 844a
842b ↗		Wind speed: 34m/s 844b
842c ↗		None 844c
842d ↗		6.1 844d
842e ↗		None 844e
842f ↗		None 844f

FIG. 8C

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DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	PLATFORM, SYSTEMS, AND METHODS FOR IDENTIFYING PROPERTY CHARACTERISTICS AND PROPERTY FEATURE MAINTENANCE THROUGH AERIAL IMAGERY ANALYSIS
---------------------------	---

As the below named inventor, I hereby declare that:

This declaration is directed to: ☒ The attached application, or
☐ United States application or PCT international application number _____
 filed on _____

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

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

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

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: Takeshi Okazaki Date (Optional): 25 September 2017

Signature: Takeshi Okazaki

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. 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 1 minute 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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PTO/SB/08a (02-18)

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

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	Filing Date		2020-01-03
	First Named Inventor	Takeshi Okazaki	
	Art Unit		
	Examiner Name		
	Attorney Docket Number	474139US02	

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Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear
	1	10311302		2019-06-04	Kottenstette et al.	
	2	9141872		2015-09-22	Marchisio et al.	
	3	9569690		2017-02-14	Marchisio et al.	
	4	9858645		2018-01-02	Malitz	
	5	9031325		2015-05-12	Ouzounis	
	6	8682079		2014-03-25	Ouzounis	
	7	9589210		2017-03-07	Estrada et al.	
	8	10013774		2019-07-03	Estrada et al.	

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	Examiner Name		
	Attorney Docket Number	474139US02	

	9	9147132		2015-09-29	Marchisio et al.	
	10	9619734		2017-04-11	Marchisio et al.	
	11	9495618		2016-11-15	Tabb	
	12	9767565		2017-09-19	Estrada et al.	
	13	10157479		2018-12-18	Estrada et al.	
	14	9904849		2018-02-27	Estrada et al.	
	15	9230168		2016-01-05	Gueguen	
	16	8145578		2012-03-27	Pershing et al.	
	17	8670961		2014-03-11	Pershing et al.	
	18	9514568		2016-12-06	Pershing et al.	
	19	8731234		2014-05-20	Ciarcia et al.	

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	20	9070018		2015-06-30	Ciarcia et al.	
	21	8995757		2015-03-31	Ciarcia et al.	
	22	8825454		2014-09-02	Pershing	
	23	9135737		2015-09-15	Pershing	
	24	8818770		2014-08-26	Pershing	
	25	9129376		2015-09-08	Pershing	
	26	8078436		2011-12-13	Pershing et al.	
	27	8170840		2012-05-01	Pershing	
	28	8209152		2012-06-26	Pershing	
	29	10217207		2019-02-26	Marra et al.	
	30	10178303		2019-01-08	Castillo et al.	

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	31	9639960		2017-05-02	Loveland et al.	
	32	8775219		2014-07-08	Swanson et al.	
	33	10402676		2019-09-03	Wang et al.	
	34	8977520		2015-03-10	Stephens et al.	
	35	10346935		2019-07-09	Thornberry et al.	
	36	9183538		2015-11-10	Thornberry et al.	
	37	9330494		2016-05-03	Schultz	
	38	9959667		2018-05-01	Schultz	
	39	10198857		2019-02-05	Schultz	
	40	8401222		2013-03-19	Thornberry et al.	
	41	8515125		2013-08-20	Thornberry et al.	

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	42	8542880		2013-09-24	Thornberry et al.	
	43	9329749		2016-05-03	Thornberry et al.	
	44	9244589		2016-01-26	Thornberry et al.	
	45	9933254		2018-04-03	Thornberry et al.	
	46	8873842		2014-10-28	Robinson et al.	
	47	10410289		2019-09-10	Tofte et al.	
	48	10102589		2018-10-16	Tofte et al.	
	49	10134092		2018-11-20	Harvey et al.	
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	Attorney Docket Number	474139US02	

1	20150317740		2015-11-05	Emison et al.	
2	20170161559		2017-06-08	Du et al.	
3	20170330032		2017-11-16	Du et al.	
4	20140245165		2014-08-28	Battcher et al.	
5	20140245210		2014-08-28	Battcher et al.	
6	20150370928		2015-12-24	Pershing	
7	20130311240		2013-11-21	Pershing et al.	
8	20170053436		2017-02-23	Pershing et al.	
9	20120209782		2012-08-16	Pershing et al.	
10	20160155097		2016-06-02	Venkatesha	
11	20150025914		2015-01-22	Lekas	

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	Art Unit		
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	12	20160350907		2016-12-01	Simula et al.	
	13	20150363717		2015-12-17	Lim	
	14	20160063642		2016-03-03	Luciani et al.	
	15	20140278697		2014-09-18	Thornberry et al.	
	16	20150178416		2015-06-25	Stephens et al.	
	17	20140237430		2014-08-21	Thornberry et al.	
	18	20150310557		2015-10-29	Engelhorn	
	19	20150310558		2015-10-29	Cuttell et al.	
	20	20170154131		2017-06-01	Loveland et al.	
	21	20170277980		2017-09-28	Taylor et al.	
	22	20150302529		2015-10-22	Jagannathan	

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	23	20140019166		2014-01-16	Swanson et al.	
	24	20160259994		2016-09-08	Ravindran et al.	
	25	20090265193	A1	2009-10-22	Collins et al.	
	26	20150325064	A1	2015-11-12	Downey et al.	
	27	20160086285	A1	2016-03-24	Jordan Peters et al.	
	28	20130226667	A1	2013-08-29	Terrazas et al.	
	29	20050063563	A1	2005-03-24	Soliman	
	30	20140032433	A1	2014-01-30	Eick et al.	
	31	20100215212	A1	2010-08-26	Flakes, JR.	
	32	20100179787	A2	2010-07-15	Pershing et al.	

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Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ² i	Kind Code ⁴	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear	T ⁵
	1	2017040691	WO	A1	2017-03-09	CAPE ANALYTICS, INC.	Previously submitted in related appln. no. 15/714,376	
	2	2017151673	WO	A1	2017-09-08	DIGITALGLOBE, INC.	Previously submitted in related appln. no. 15/714,376	
	3	2015009798	WO	A1	2015-01-22	DIGITALGLOBE, INC.	Previously submitted in related appln. no. 15/714,376	
	4	2015017366	WO	A1	2015-02-05	DIGITALGLOBE, INC.	Previously submitted in related appln. no. 15/714,376	
	5	2015038358	WO	A1	2015-03-19	DIGITALGLOBE, INC.	Previously submitted in related appln. no. 15/714,376	
	6	2016053791	WO	A1	2016-04-07	DIGITALGLOBE, INC.	Previously submitted in related appln. no. 15/714,376	
	7	2014151122	WO	A1	2014-09-25	EAGLE VIEW TECHNOLOGIES, INC.	Previously submitted in related appln. no. 15/714,376	
	8	2017142788	WO	A1	2017-08-24	PICTOMETRY INTERNATIONAL CORP.	Previously submitted in related appln. no. 15/714,376	
	9	2012054239	WO	A2	2012-04-26	PICTOMETRY INTERNATIONAL CORP.	Previously submitted in related appln. no. 15/714,376	
	10	2012054239	WO	A3	2012-04-26	PICTOMETRY INTERNATIONAL CORP.	Previously submitted in related appln. no. 15/714,376	

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	Attorney Docket Number	474139US02		

11	2013142406	WO	A1	2013-09-26	PICTOMETRY INTERNATIONAL CORP.	Previously submitted in related appln. no. 15/714,376
12	2017186515	WO	A1	2017-11-02	SIEMENS AKTIENGESELLSCHAFT	Previously submitted in related appln. no. 15/714,376
13	2013123354	WO	A1	2013-08-22	XACTWARE SOLUTIONS, INC.	Previously submitted in related appln. no. 15/714,376
14	2015017855	WO	A1	2015-02-05	XACTWARE SOLUTIONS, INC.	Previously submitted in related appln. no. 15/714,376
15	2018058044	WO	A1	2018-03-29	AON BENFIELD INC.	Previously submitted in related appln. no. 15/714,376

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	1	International Search Report and Written Opinion issued in International Application No. PCT/US2017/053265 on December 11, 2017. (Previously submitted in related appln. no. 15/714,376)	
	2	International Patent Report on Patentability issued in International Application No. PCT/US2017/053265 on March 26, 2019. (Previously submitted in related appln. no. 15/714,376)	
	3	LIN, et al., Network in Network, International Conference on Learning Representations, 2014, pp. 10. (Previously submitted in related appln. no. 15/714,376)	
	4	KRIZHEVSKY, et al., ImageNet Classification with Deep Convolutional Neural Networks, Advances in neural information processing systems, 2012, pp. 9. (Previously submitted in related appln. no. 15/714,376)	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		
	Filing Date		2020-01-03
	First Named Inventor	Takeshi Okazaki	
	Art Unit		
	Examiner Name		
	Attorney Docket Number		474139US02

5	Non-Final Office Action mailed in U.S. Appln. No. 15/714,376, dated March 21, 2019. (Submitted herewith)
6	Notice of Allowance mailed in U.S. Appln. No. 15/714,376, dated August 7, 2019. (Submitted herewith)
7	Notice of Allowance mailed in U.S. Appln. No. 15/714,376, dated November 20, 2019. (Submitted herewith)
8	Systems and Methods for Insurers to Monitor Continuously Structural Status of Insured Homes, IP.com Number: IPCOM000177511D, December 16, 2008. (Year: 2008) (Previously submitted in related appln. no. 15/714,376 by Examiner)

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Name/Print	Natalie J. Grace	Registration Number	65803

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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.
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PTO/SB/08a (02-18)

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	1	9928553		2018-03-27	Harvey et al.		
	2	10173773		2019-01-08	Flick		
	3	10137984		2018-11-27	Flick		
	4	10163164		2018-12-25	Tofte et al.		
	5	9501700		2016-11-22	Loveland et al.		
	6	9679227		2017-06-13	Taylor et al.		
	7	10453147		2019-10-22	Davis		
	8	6732120	B1	2004-05-04	Du		

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	9	9846915	B2	2017-12-19	Howe et al.	
	10	8346578	B1	2013-01-01	Hopkins, III et al.	

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In the United States Patent and Trademark Office

Application for United States Patent

Title

Platform, Systems, and Methods for Identifying Property Characteristics and
Property Feature Conditions Through Aerial Imagery Analysis

Inventor(s)

Takeshi Okazaki (Tokyo, Japan)

Authorized Representative

Greg H. Gardella (Reg. No. 46,045)
Natalie J. Grace (Reg. No. 65,803)

Attorney Docket No.

474139US02

RELATED APPLICATIONS

[0001] This application is a continuation-in-part of and claims priority to U.S. Patent Application Serial No. 15/714,376 entitled “Platform, Systems, and Methods for Identifying Property Characteristics and Property Feature Maintenance Through Aerial Imagery Analysis” and filed September 25, 2017, which claims priority to U.S. Provisional Patent Application Serial No. 62/398, 665, entitled “Platform, Systems, and Methods for Identifying Property Characteristics and Property Feature Maintenance Through Aerial Imagery Analysis,” filed September 23, 2016. All above identified applications are hereby incorporated by reference in their entireties.

BACKGROUND

[0002] A risk exposure database contains a compilation of as many building properties or characteristics relevant to insurance as possible. These properties can include characteristics like location coordinates, address, slope, and elevation. Other characteristics include construction type, occupancy type, year built and/or year of renovation, building height, soft stories, number of stories, and floor area. Further characteristics can include roof condition, roof shape, roof covering, roof anchors, roof equipment, cladding, and pounding (distance to closest building). Some of these characteristics can only be assessed by on-site inspections or by official documentation, but others can be measured using visual imagery.

[0003] Characteristics addressed in this disclosure include roof shape and roof condition. In one example, roof shapes can be broken into five categories: gambrel roof, gable roof, hipped roof, square roof, and flat roof. Each roof shape has a unique response and damage vulnerability to different natural perils like earthquake or wind.

[0004] Deep learning involves computational models composed of multiple processing layers to learn representations of data with multiple levels of abstractions. These models can be

thought of as a way to automate predictive analytics. Representation learning is a set of methods that allows a machine to be fed with raw data and to automatically discover the representations needed for detection or classification. Use cases for deep learning include voice recognition, motion detection, translation, and medical diagnosis. By using deep learning algorithms and sample datasets, computers can learn to distinguish and classify a wide range of characteristics to high levels of accuracy, often surpassing the recognition levels of human beings.

[0005] One model used for deep learning is the Network in Network model described in the paper “Network In Network” by M. Lin et al. and published in the International Conference on Learning Representations, 2014 (arXiv:1409.1556), the contents of which are hereby incorporated by reference in its entirety. Using the Network in Network model, a number of layers of artificial perception outcomes are generated using micro neural networks with complex structures. The artificial perception outcomes are then stacked and averaged to generate a single global average pooling layer for classification.

[0006] When applied to visual recognition, deep learning algorithms can break down an observation (e.g., an image) in a number of different ways to characterize features of the observation. In some examples, deep learning algorithms can be applied to review images as a set of intensity values per pixel, or in a more abstract way as a set of edges, regions of particular shape, etc. Some representations may demonstrate superior performance to others based upon the particular learning task. One of the promises of deep learning is replacing human identification of features with efficient algorithms for unsupervised or semi-supervised feature learning and hierarchical feature extraction.

[0007] The inventors recognized that deep learning methodology could be applied to risk exposure database population to analyze aerial imagery and automatically extract characteristics of individual properties, providing fast and efficient automated classification

of building styles and repair conditions. In combining location-based vulnerabilities with individual property vulnerabilities identified in part through classification of repair conditions of one or more property features, risk of damage due to disaster can be more accurately estimated.

SUMMARY OF ILLUSTRATIVE EMBODIMENTS

[0008] The forgoing general description of the illustrative implementations and the following detailed description thereof are merely exemplary aspects of the teachings of this disclosure, and are not restrictive.

[0009] Systems, methods, and computing system platforms described herein support matching aerial image features of one or more properties to corresponding property conditions (e.g., maintenance levels of property features, including structural features, manmade features included within a vicinity of a structure (e.g., on a property lot, within a property parcel, or a geographic region of the property), and/or natural features included within the vicinity of the structure) through machine learning analysis. In a preferred application, the property condition analysis may be used in estimating damage risk in light of one or more disaster conditions, such as severe storms. The analysis may further aid in estimating costs of repair or replacement of each property, in one example, should a disaster cause the estimated damage. In another example, the analysis may be used to confirm that a property has been repaired.

[0010] In one aspect, the present disclosure relates to a method for automatically categorizing a repair condition or maintenance condition of a property characteristic, including obtaining an aerial image of a geographic region including the property; identifying features of the aerial image corresponding to the property characteristic; analyzing the features to determine a property characteristic classification; analyzing a region of the aerial image including the property characteristic to determine a condition classification; and determining, using the

property characteristic classification and the condition classification, a risk estimate of damage to the property due to one or more disasters. The property characteristic of a structure such as a house, factory, or barn, in some examples, can include a rooftop, porch, chimney, or skylights. Property characteristics of manmade structures within a property location, in some examples, can include a deck, swimming pool, shed, gazebo, detached garage, tennis court, fence, retaining wall, dock, playground equipment, equipment or vehicles, or greenhouse. Property characteristics of natural features within a property location, in some examples, include trees, ponds, marshes, rivers, lakes, grasses, cliffs, or ocean shore. Further, property characteristic classifications can include shapes, materials, size (breadth and/or height, relative or actual), and/or distance of the property characteristic from other features. In some embodiments, the property characteristic classification may include existing versus not existing (e.g., in the event of determining replacement or removal of a manmade feature at a property location such as a fence). The property characteristic classification, in a particular illustration, may be a rooftop shape. Analyzing the features to determine a property characteristic may include applying a deep learning analysis model to the features. The deep learning analysis model may be NIN.

[0011] In some embodiments, analyzing the region of the aerial image including the property characteristic to determine the condition classification includes applying a machine learning analysis model to image pixels within the region. The machine learning analysis model may include a color histogram analysis model. The condition classification may encompass classifications good and bad. Determining the risk estimate may include applying a disaster risk profile corresponding to a first disaster of the at least one disaster and the property characteristic.

[0012] In one aspect, the present disclosure relates to a system for automatically categorizing a repair condition of a property characteristic, the system including processing circuitry and a

non-transitory computer-readable medium having instructions stored thereon. In some embodiments, the instructions, when executed by the processing circuitry, cause the processing circuitry to obtain an aerial image of a geographic region including the property; identify features of the aerial image corresponding to the property characteristic; analyze the features to determine a property characteristic classification; analyze a region of the aerial image including the property characteristic to determine a condition classification; and determine, using the property characteristic classification and the condition classification, a replacement cost for replacing the property characteristic. The aerial image may be a two-dimensional aerial image.

[0013] In some embodiments, the instructions, when executed by the processing circuitry, cause the processing circuitry to, prior to identifying the features, obtain a shape map image including the property; overlay the aerial image with the shape map image; and determine whether a boundary of the property as identified by the shape map matches a boundary of the property as illustrated in the aerial image. The instructions, when executed by the processing circuitry, may cause the processing circuitry to, upon determining that the shape map does not match the boundary of the corresponding property, obtain an alternate aerial image of the property. The instructions, when executed by the processing circuitry, may cause the processing circuitry to, prior to identifying the features, assess orthogonality of the aerial imagery. The property may be a single family home.

[0014] In one aspect, the present disclosure relates to a non-transitory computer readable medium having instructions stored thereon, where the instructions, when executed by processing circuitry, cause the processing circuitry to receive identification of a property and at least one property characteristic; obtain an aerial image of a geographic region including the property; and identify respective features of the aerial image corresponding to each property characteristic of the at least one property characteristic. In some embodiments, the

instructions, when executed by the processing circuitry, cause the processing circuitry to, for each property characteristic, analyze the corresponding features to determine a respective property characteristic classification, and analyze a region of the aerial image including the respective property characteristic to determine a respective condition classification. The instructions, when executed by the processing circuitry, may cause the processing circuitry to determine, using the property characteristic classification of each property characteristic and the condition classification of each property characteristic, at least one risk estimate representing risk of damage due to disaster.

[0015] In some embodiments, the instructions, when executed by the processing circuitry, cause the processing circuitry to, prior to obtaining the aerial image of the geographic region, determine, based upon the at least one property characteristic, a preferred image type corresponding to each property characteristic of the at least one property characteristic. The at least one property characteristic may include two or more property characteristics. The instructions, when executed by the processing circuitry, may cause the processing circuitry to, responsive to determining the preferred image type corresponding to a first property characteristic of the at least one property characteristic is a terrestrial image, obtain a terrestrial image of the geographic region including the property.

[0016] In some embodiments, the instructions, when executed by the processing circuitry, cause the processing circuitry to access one or more known property characteristics. Determining the at least one risk estimate may include determining the at least one risk estimate further based on the one or more known property characteristics. The one or more known property characteristics may include at least one of a property age, a property elevation, a property slope, a year built, a year renovated, and a building height.

[0017] In some embodiments, receiving identification of the property and the at least one property characteristic includes receiving, via a network from a remote computing device, the

identification of the property. The instructions, when executed by the processing circuitry, may cause the processing circuitry to provide, via the network to the remote computing device in real-time responsive to receiving the at least one property characteristic, the at least one risk estimate.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] The accompanying drawings, which are incorporated in and constitute a part of the specification, illustrate one or more embodiments and, together with the description, explain these embodiments. The accompanying drawings have not necessarily been drawn to scale. Any values dimensions illustrated in the accompanying graphs and figures are for illustration purposes only and may or may not represent actual or preferred values or dimensions. Where applicable, some or all features may not be illustrated to assist in the description of underlying features. In the drawings:

[0019] FIG. 1 is a flow diagram of an example system operational flow for matching aerial image features to corresponding property maintenance levels;

[0020] FIG. 2A illustrates example characteristic classifications and corresponding risk profile data;

[0021] FIG. 2B illustrates examples of condition characteristics and corresponding example histograms;

[0022] FIG. 2C illustrates an example condition profile corresponding to an example property characteristic type;

[0023] FIG. 2D is an example error rate graph comparing training data with test data in conducting matching aerial image features to corresponding rooftop shapes;

[0024] FIG. 3 is a block diagram of an example environment for matching aerial image topographical features to corresponding property maintenance levels;

[0025] FIG. 4 is a flow chart of an example method for classifying condition characteristics of a property based on aerial image analysis;

[0026] FIG. 5A illustrates an example structure shape map of a geographic area;

[0027] FIG. 5B illustrates an example two-dimensional aerial image of the geographic area of FIG. 5A;

[0028] FIG. 5C illustrates an example overlay map image of a section of the structure shape map of FIG. 5A overlaying a corresponding section of the aerial image of FIG. 5B;

[0029] FIG. 6 is a block diagram of an example computing system;

[0030] FIG. 7 is a block diagram of an example distributing computing environment including a cloud computing environment; and

[0031] FIGs. 8A through 8C illustrate a series of example user interface screen shots for reviewing property characteristic and maintenance level information.

DETAILED DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

[0032] The description set forth below in connection with the appended drawings is intended to be a description of various, illustrative embodiments of the disclosed subject matter.

Specific features and functionalities are described in connection with each illustrative embodiment; however, it will be apparent to those skilled in the art that the disclosed embodiments may be practiced without each of those specific features and functionalities.

[0033] Reference throughout the specification to “one embodiment” or “an embodiment” means that a particular feature, structure, or characteristic described in connection with an embodiment is included in at least one embodiment of the subject matter disclosed. Thus, the appearance of the phrases “in one embodiment” or “in an embodiment” in various places throughout the specification is not necessarily referring to the same embodiment. Further, the particular features, structures or characteristics may be combined in any suitable manner in

one or more embodiments. Further, it is intended that embodiments of the disclosed subject matter cover modifications and variations thereof.

[0034] It must be noted that, as used in the specification and the appended claims, the singular forms “a,” “an,” and “the” include plural referents unless the context expressly dictates otherwise. That is, unless expressly specified otherwise, as used herein the words “a,” “an,” “the,” and the like carry the meaning of “one or more.” Additionally, it is to be understood that terms such as “left,” “right,” “top,” “bottom,” “front,” “rear,” “side,” “height,” “length,” “width,” “upper,” “lower,” “interior,” “exterior,” “inner,” “outer,” and the like that may be used herein merely describe points of reference and do not necessarily limit embodiments of the present disclosure to any particular orientation or configuration. Furthermore, terms such as “first,” “second,” “third,” etc., merely identify one of a number of portions, components, steps, operations, functions, and/or points of reference as disclosed herein, and likewise do not necessarily limit embodiments of the present disclosure to any particular configuration or orientation.

[0035] Furthermore, the terms “approximately,” “about,” “proximate,” “minor variation,” and similar terms generally refer to ranges that include the identified value within a margin of 20%, 10% or preferably 5% in certain embodiments, and any values therebetween.

[0036] All of the functionalities described in connection with one embodiment are intended to be applicable to the additional embodiments described below except where expressly stated or where the feature or function is incompatible with the additional embodiments. For example, where a given feature or function is expressly described in connection with one embodiment but not expressly mentioned in connection with an alternative embodiment, it should be understood that the inventors intend that that feature or function may be deployed, utilized or implemented in connection with the alternative embodiment unless the feature or function is incompatible with the alternative embodiment.

[0037] Turning to FIG. 1, a flow diagram of an example system operational flow 100 for matching aerial image features to corresponding property maintenance levels obtains images (104) at property locations 102b is illustrated. In some implementations, commencement of at least a portion of the operational flow 100 by the system may be triggered by a property classification request submitted by a user, such as an insurance carrier or real estate investment broker at a dashboard interface screen on a computing device connected to the system via a network. For example, as illustrated in FIG. 8A, a particular property or, alternatively, a neighborhood of properties, may be selected within a map view user interface 800. The operational flow 100 may be used to analyze the condition of features of each property at each property location 102b based on aerial imagery 102c. In some implementations, the operational flow 100 may aid in estimating costs of repair or replacement of each property characteristic detected in the aerial images, for example. In another example, the operational flow 100 may be used to confirm that a property location 102b has been repaired.

[0038] The property locations 102b may represent, in some examples, locations of properties insured by a particular insurer, locations of properties recently affected by a disaster such as a tornado, hurricane, earthquake, fire, storm surge, or explosion, locations of properties held in an investment portfolio, or locations of properties considered for addition to an investment portfolio. The property locations 102b may be identified, in some examples, by a street address, global positioning system coordinates, or other geographic coordinates.

[0039] In some implementations, the operational flow 100 obtains images (104) at each property location 102b. The images can include aerial imagery 102c stored by the system or accessed by the system from a remote networked location. The aerial imagery 102c, for example, may include a three-dimensional or two-dimensional image of a geographic location including at least one of the property locations 102b. In one example, based upon

street address or geographic coordinates, the system may query a remote database to obtain recent aerial imagery 102c including an image of at least one of the property locations 102b. The remote database, in some examples, can include private industry databases such as Google® Earth images by Google, Inc. of Mountain View, CA or NTT Geospace Corporation of Japan. In other examples, the remote database can include one or more databases of publicly owned organizations such as the Geospatial Information Authority (GSI) of Japan, the United States Geological Survey, or the Federal Agency for Cartography and Geodesy of Germany. Aerial imagery can be collected from one or more remote network locations, in some embodiments, using an Open Source Geographic Information System (GIS) such as QGIS by the Open Source Geospatial Foundation (OSGeo). The format for the images of the property locations 102b, in some embodiments, depends upon the format accepted by the various sources available for aerial imagery 102c. An example aerial image 510 of multiple property locations 102b is illustrated in FIG. 5B.

[0040] In some embodiments, the system may be configured to query multiple remote database systems to obtain at least two aerial images of a given property location 102b. The aerial images available at the various databases, for example, may differ in resolution and recency of capture. Through collecting two or more images of a particular property, for example, the system may analyze each image to determine a best quality image for use in condition analysis. The condition analysis can include balancing of multiple factors such as, in some examples, clarity, completeness, and recency.

[0041] Further, in some embodiments, the system may be configured to query multiple remote database systems to obtain both a two-dimensional aerial image and a three-dimensional aerial image. Different property characteristics may be discerned based upon whether the aerial image is captured in two-dimensional or three-dimensional format. Two-dimensional aerial images, in some examples, can be used to determine location coordinates

of the property, street name, occupancy type, floor area, existence of skylights, existence of chimneys, roof condition, roof shape, roof covering, roof anchors, roof equipment, and/or pounding. Three-dimensional aerial images, in comparison, can be used to determine location coordinates, street name, construction type, occupancy type, year built, building height, soft stories, number of stories, roof condition, roof shape, roof covering, roof anchors, roof equipment, cladding, and pounding. Where there is an overlap in characteristics identifiable using either a two-dimensional image or a three-dimensional image, in some embodiments, machine learning analysis of both images can be combined to provide increase confidence in identification of the individual characteristics.

[0042] In some implementations, the system obtains (104) shape map images 102a of each of the property locations 102b. The shape map images 102a, for example, include a block shape layout of existing properties in a municipality, such as urban planning maps used in urban planning and development. The shape map images 102a, in another example, can include block shape layout maps used in presenting information to a user of a computer-based navigation system. The shape map images 102a, in one example, can be obtained from Geospatial Information Authority of Japan or Zenrin Co. Ltd. of Japan. An example of an urban planning map 500 is illustrated in FIG. 5A (image obtained from the Geospatial Information Authority of Japan, Digital Map 2500 (Spatial Data Framework)).

[0043] The shape map images 102a, in some embodiments, are used to confirm location of a particular property. The shape map image 102a of a geographical area, for example, can be overlaid with a corresponding aerial image 102c to match properties with images. An example overlaid image 520 of planning map image 500 of FIG. 5A with aerial image 510 of FIG. 5B is illustrated in FIG. 5C. In some embodiments, the shape map image 102a may not match in shape or location with the aerial image 102c. As illustrated in FIG. 5C, for example, a shape map outline (illustrated in a thickened line) for a location 522 may not be

rectangular, while a rooftop shape beneath the outline may be rectangular in shape. In some embodiments, analyzing multiple aerial images 102c to determine the best quality image may include identifying one or more aerial images 102c that substantially align with the corresponding shape map image 102a. The overlay of the aerial image 102c with the shape map image 102a, further, can be used in aiding in cropping the aerial image 102c to focus analysis on a particular property location 102b. For example, turning to FIG. 5C, property location 524 is substantially aligning with the corresponding planning map image, and the general outline can be used in aiding in cropping of the property location 524. In some examples, the property location 524 may be identified within the overlaid image 520 when the property location 524 aligns with a property in the overlaid image 520 within a predetermined tolerance in order to account for renovations that may have been made to the property 524, such as property additions that may alter an overall shape of the property.

[0044] Returning to FIG. 1, in some embodiments, the shape map images 102a may be used to correct or compensate for alignment errors or inconsistencies of the corresponding two-dimensional aerial images 102c. For example, an aerial image representing a normal orthophoto angle may not be directly centered upon the planning map block. Using the planning map block as a guide, for example, the aerial image can be geometrically corrected to obtain a true orthophoto version of the aerial image.

[0045] As illustrated in FIG. 1, in some implementations, the system identifies (106) features of each aerial image 102c to classify property characteristics. Using machine learning for analysis, for example, the system can extract features of the aerial image of a particular property location 102b. Groupings of extracted features, such as angles, outlines, substantially homogenous fields, etc. can be used to identify property features such as rooftop, swimming pool, chimney, and sky lights. The groupings of extracted features, for example, may include pixel groupings obtained through filtering, cropping, or otherwise

adjusting the original image. Upon extracting image-related features identifiable as a property feature (e.g., rooftop), the extracted features may be analyzed to determine one or more property characteristics of that feature (e.g., type of rooftop). In one example, a swimming pool may be identified as the property feature of a pool (e.g., various shapes of outlines of a particular size or greater bordering a substantially homogenous field of blue), then characterized as a particular shape (e.g., rectangular, round, or kidney bean, etc.), type (e.g., above ground or in-ground), and/or size (e.g., approximate area). The machine learning classifier used in the machine learning analysis, in some embodiments, includes a convolutional neural network (CNN) to preprocess the aerial image 102c of the particular property location 102b and to classify the property features as property characteristics 110. Using CNN technology, for example, the biological process of visually reviewing and identifying an object or feature of an object is mimicked through a feed-forward artificial neural network where multilayer artificial perception minimizes preprocessing. CNN is a well-established and popular machine-learning methodology. An example of a CNN processing model is Alexnet. (See Krizhevsky et al. "ImageNet Classification with Deep Convolutional Neural Networks", Advances in neural information processing systems. 2012, the entire contents of which has been incorporated herein by reference). In other embodiments, the machine learning classifier may include a Network in Network (NIN) where a number of layers of artificial perception outcomes are generated using micro neural networks with complex structures. The artificial perception outcomes are then stacked and averaged to generate a single global average pooling layer for classification. NIN has demonstrated superior performance outcome to conventional CNN processing. Additionally, NIN processing is less storage-intensive than CNN processing.

[0046] In some implementations, property characteristic profiles 108 are used in classifying property features. The property characteristic profiles 108, for example, may be developed

through training the machine learning algorithms using aerial images (and, in some embodiments, terrestrial images 102d) of known property characteristics. Each property feature, for example, may be broken down into multiple classifications. In an illustrative example involving a classification of terrestrial images, cladding can include stone, brick, stucco, shingles, vertical boards, horizontal boards, or metal. The machine learning algorithms, for example, may generate a percentage confidence in a match between a new aerial image 102c including a gambrel rooftop and the characteristic profile 108 of gambrel rooftops.

[0047] In an illustrative example, turning to FIG. 2A, extracted angular and outline features of aerial images 204 may be used to classify a roof shape 202 of the particular property location 102b. In a first example, a gable roof 202b includes a central peak upon a generally rectangular outline, as depicted in corresponding aerial image 204b. A gambrel roof 202a includes these features of the gable roof 202b but, as illustrated in aerial image 204a, the gambrel roof additionally includes a “skirt” region surrounding the central gable-shaped portion. The “skirt” region can be identified, in part, based upon its corner edges extending from the four corners of the gable-shaped portion. A hipped roof 202c, as shown in aerial image 204c, includes a central peak and two opposing triangular ends extending from either end of the central peak. The central peak forms a top edge of two trapezoidal sections. A square roof 202d, in contrast, has no central peak. Instead, as illustrated in aerial image 204d, the square roof includes four triangular portions meeting at a central point. Finally, a flat roof 202e, as shown in aerial image 204e, is represented by a substantially flat surface outlined by a rectangle.

[0048] Turning to FIG. 2D, an example error rate graph 240 compares training data 242 with accuracy of matching test data 244 in matching aerial image rooftop characteristics to corresponding rooftop type (e.g., shape). A test was conducted using NIN deep learning

algorithms to classify rooftop shape in two-dimensional aerial images including a mix of gambrel, gable, hipped, square, and flat roof shapes of assorted colors. Further tests involved differing image sizes and mini-batch sizes. In particular, images were scaled using a formula of $y = w * (x-100) + z$, where x represents a property size (e.g., building with a small border surrounding the area of the rooftop), y represents pixel size, w ranged from 0.33 to 0.40 and z ranged from 90 to 110. The error rates ranged, among initial test cases involving mini batches from 5 to 20, from about 4.3% to about 10%. As shown by the error rate graph 240, in a test situation involving 2,250 sample images in a training dataset and 250 test images in a test dataset, the minimum error rate in determining rooftop condition was 6%, corresponding to an accuracy rate of 94%.

[0049] To improve accuracy rate, in some implementations, the image can be cropped and/or resized prior to analyzing. For example, the image may be cropped to include the property of interest, or the property of interest plus a portion of its surroundings (e.g., the lot containing the property and/or a portion of the proximate neighborhood in which the property resides). Resizing to a standard image size, in another example, can contribute to accuracy improvement.

[0050] Further to roof shape, in some embodiments, feature analysis can be used to discern additional roof features such as, in some examples, roof covering, roof anchors, roof equipment, skylights, widow's walks, turrets, towers, dormers, and/or chimneys. Furthermore, upon identifying the outline of the roof, a footprint of the property location 102b (e.g., size of the roof) can be calculated based upon a scale of the aerial image 102c.

[0051] Returning to FIG. 1, rather than exclusively analyzing the particular property locations 102b individually, in some implementations, the particular property locations 102b are each classified based in part upon nearby structures. For example, based upon property location 102b dimensions, which may include lot dimensions, machine learning can be used

to identify additional structures at the property location 102b such as, in some examples, a deck, swimming pool, shed, gazebo, detached garage, tennis court, fence, retaining wall, dock, playground equipment, or greenhouse. Further, the particular property locations 102b may be classified in part based upon distance from neighboring structures and/or natural features (e.g., ponding).

[0052] In some implementations, terrestrial images 102d may be used to classify features difficult to recognize using aerial imagery 102c. The terrestrial images 102d, in some examples, can include street view images obtained from a street view service or real estate listing. In some examples, street view images including a street-facing view of the property location 102b may be obtained from Google® Street View by Google, Inc., Bing® Maps Streetside by Microsoft Corp. of Redmond, WA, or Mapillary by Mapillary AB of Sweden. Using a terrestrial image, for example, the system can identify features such as construction type, cladding, building height, number of soft stories, number of floors, location coordinates, street name, slope, elevation, year built, and/or occupancy type. Where the characteristics identifiable via the terrestrial imagery 102d overlap with characteristics identifiable via two-dimensional or three-dimensional aerial imagery 102c, analysis of terrestrial imagery 102d can be combined with analysis of aerial imagery, in some embodiments, to increase confidence in identification of the particular characteristic(s). For example, house siding features may be more easily detected in terrestrial imagery 102d and/or three-dimensional aerial imagery 120c than in two-dimensional aerial imagery 102c.

[0053] In some implementations, a condition of each property feature may be classified (112) as a corresponding condition characteristic 116. New properties are in good condition, but property feature conditions can deteriorate over time due to normal wear-and-tear on the property. Further, property features can suffer damage due to external forces such as storms and natural disasters. Eventually, conditions of housing features can deteriorate to the point

where repair and/or replacement may be necessary. As with property characteristics described above at block 106, machine learning algorithms can be used to classify a present condition of individual detected property features. Using machine learning for analysis, for example, the system can extract pixel intensity distributions of previously identified property features of the aerial image of the particular property location 102b. In some examples, newly constructed property features generally have sharp contrast and well-defined features in machine learning image analysis. Conversely, weathered or damaged property features can have softened edges, blurred contrasts, and asymmetrical patches of wear. The machine learning classifier used in the machine learning condition analysis, in some embodiments, includes a machine learning analysis to process the aerial image 102c of the particular property location 102b and to classify the condition of previously identified property characteristics 110 as condition characteristics 116. The machine learning analysis, in some examples, can include two-dimensional color histogram analysis or three-dimensional color histogram analysis. In other embodiments, the machine learning analysis may be performed using pattern recognition algorithms (e.g., determining missing fence posts or missing/misaligned rooftop shingles). In other embodiments, the machine learning classifier includes deep learning analysis such as CNN or NIN. For example, CNN analysis may leverage feature maps created during the training process to assess the condition through extracting meaningful features within a given image through convolution and pooling layers. Other machine learning models and algorithms are possible.

[0054] In an illustrative example, turning to FIG. 2B, examples of condition characteristics of aerial images of hipped rooftops and corresponding example histograms generated through machine learning analysis of pixel intensity are presented. For example, a set of good condition aerial images 210a through 214a, are presented alongside corresponding good condition histograms 210b through 214b. The good condition histograms 210b through 214b,

in an illustrative embodiment, illustrate probability metrics of grayscale color distribution, where a respective maximum value 210c through 214c demonstrates the peak probability of grayscale color distribution of a good condition roof. The values, for example, can range from 0 (total black) to 255 (total white).

[0055] Conversely, a set of poor condition aerial images 216a through 220a, are presented alongside corresponding poor condition histograms 216b through 220b. The poor condition histograms 216b through 220b, in an illustrative embodiment, illustrate probability metrics of grayscale color distribution, where a respective maximum value 216c through 220c demonstrates the peak probability of grayscale color distribution of a good condition roof. The maximum values 216c through 220c corresponding to the poor condition rooftops 216a through 220a are markedly lower than corresponding maximum values 210c through 214c of good condition rooftops 210a through 214a. In addition, a width of the distributions of the poor condition histograms 216b through 220b may be markedly wider than a width of the distributions of the good condition histograms 210b through 214b. As can be seen of the aerial images of the poor condition rooftops 216a through 220a, the color distribution is patchy and bleached out, while the edges of the rooftops have lost their crisp lines.

Conversely, looking to the aerial images of the good condition rooftops 210a through 214a, the rooftops are more substantially uniform in color with crisp lines on the edges.

[0056] Turning to FIG. 2C, a condition profile 230 for a rooftop condition is illustrated. In some implementations, pixel value distribution histograms such as the histograms 210b through 220b, in some implementations, can be combined to generate an example condition profile 230 corresponding to rooftop condition. The condition profile 230, for example, may be included as one of the condition profiles 114 of FIG. 1. Example reference bars 232a, 232b on the condition profile 230 illustrate values corresponding to a non-deteriorated hipped roof 214a and the deteriorated hipped roof 216a, respectively. In some examples, the closer

the value of a reference bar 232 comes to 1 on the Y-axis, the better the condition of the roof, while values close to 0 represent poor condition rooftops. In one example, the reference bars 232 of the example condition profile 230 correspond to a test conditions sample data set including 2,500 images). The reference bars 232 can be combined, in some embodiments, in a logistic regression to generate a roof condition profile graph 236. The accuracy rate of the image histogram is 80% based on some validation.

[0057] Although illustrated as a single condition profile 230 corresponding to different types of rooftops (e.g., at least the hipped rooftop 216a and the gable rooftop 234), in other embodiments, individual condition profiles 114 can be generated for each property characteristic (e.g., profiles specific to gabled, gambrel, flat, hipped, square, etc.). In further refinements, in certain embodiments, individual condition profiles 114 can be generated for combinations of property characteristics (e.g., a gabled, shingled roof, a gabled, clay tiled roof, a gabled, metal roof, etc.) to increase accuracy rate based upon pixel densities corresponding to the combined characteristics. Many combinations of characteristics of property features may be used singly or in combination to generate a condition profile 114 designed to accurately identify the condition of the corresponding property feature.

[0058] Returning to FIG. 1, in some implementations, the property characteristics 110 and/or condition characteristics 116 may be analyzed to calculate (120) a risk estimate 122 corresponding to a risk of damage based upon one or more types of disasters. The types of disasters can include, in some examples, earthquake, hurricane, tornado, storm surge, fire, straight line winds, or explosion. The types and estimated severity of disasters, in some embodiments, may depend upon the particular property location 102b. For example, properties near active fault lines may be more susceptible to earthquakes, while coastal properties may be more susceptible to storm surge damage. The risk estimate 122, in some examples, can include an actuarial percentage indicating a likelihood of damage based upon

the particular property characteristics. Different property characteristics, for example, may be more susceptible than others to certain types of damage. For example, flatter rooftops may be more susceptible to damage from excessive snow build-up, while peaked rooftops may be more vulnerable to strong winds.

[0059] In some embodiments, in calculating damage risk, one or more disaster risk profiles 118 can be applied based upon property characteristics. Vulnerability to damage due to disaster can vary, in some examples, by location, altitude, slope, rooftop shape, rooftop condition, cladding type, cladding condition, and/or pounding. In a particular example, as shown in FIG. 2A, a graphical risk profile 206 ranks types of rooftops by their vulnerability to strong winds. Vulnerability to wind damage increases from lowest vulnerability (flat rooftop 202e) to square roof 202d, to hipped roof 202c, to gable roof 202b, with the greatest wind damage vulnerability in gambrel roofs 202a. Vulnerability may be mathematically modeled based upon statistical information built from past damage results due to varying types and/or severity of disaster. In combining location-based vulnerabilities with individual property characteristic-based vulnerabilities, risk of damage due to disaster can be more accurately estimated.

[0060] Referring back to FIG. 1, the risk estimates 122, in some embodiments, can be used in insurance assessments. For example, the risk estimate 122 may be used in determining whether a property is adequately insured against potential damage. Further, when tracking an impending natural disaster, an insurance company may use the risk estimates 122 to estimate claims based upon the forecast path and severity of the storm. Additionally, the risk estimates 122 may be applied by investors when selecting investment properties for an investment portfolio.

[0061] In some implementations, repair or replacement costs can be calculated (126) to determine a cost estimate 128 to place one or more property characteristics in good or “like

new” condition. The cost estimates 128, in some embodiments, can be based in part on one or more replacement cost profiles 120. Replacement costs, in some examples, may vary based upon type of materials (e.g., rooftop materials, cladding materials, etc.), size of the job (e.g., estimated area of the roof, estimated length of fence, etc.), and/or additional property characteristics (e.g., contributing to the complexity of the work). The replacement profiles 120, in further examples, may be based in part on location (e.g., varying costs of material and labor regionally). In some implementations, the cost estimates 128 for repair or replacement of the property characteristics may be output to a dashboard interface screen at a remote computing device of a requester, such as an insurance carrier or real estate investment broker.

[0062] In some embodiments, cost estimates 128 can be used in automatically analyzing insurance claims. The cost estimate 128, further, may be combined with the risk estimate 122 in analyzing adequacy of insurance coverage for a particular property location 102b. Further, the cost estimates 128 may be used by investors in determining cost of maintaining/upgrading a particular investment property.

[0063] Although the operational flow is illustrated as a series of computational stages, in other implementations, more or fewer computational stages may be included. For example, aerial imagery 102c may be analyzed after an insurance claim has been paid to verify that the insured property has been repaired and/or to upgrade the estimated value of the property (e.g., in the circumstance where the owner upgraded the property rather than applying a straight repair/replacement of the damaged property characteristics).

[0064] Additionally, in other implementations, certain computational stages may be performed in a different order. For example, cost estimates 128 may be calculated prior to risk estimates 122. Other modifications of the operational flow 100 are possible.

[0065] FIG. 3 is a block diagram of an example environment 300 for matching aerial image topographical features to corresponding property maintenance levels. The example

environment 300, for example, can be used to implement the operational flow 100 described in relation to FIG. 1. The example environment 300 includes a property characteristic classification and condition analysis system 302 in communication with client computing system(s) 306, a number of cost data and/or risk data source computing system(s) 308, and a number of shape map, aerial imagery, and/or terrestrial imagery source computing system(s) 304. The communication connection may be wired or wireless, over a variety of network types. In a general overview, the system 302 obtains property identifier(s) 340 from client computing system(s) 306, accesses images of a property identified by the property identifier 340 from the imagery source computing system(s) 304, and analyzes the images to determine property characteristic(s) 342 and condition characteristic(s) 344. Using cost and/or risk data obtained from cost and risk data source computing system(s) 308, the system 302 may determine replacement cost estimate data 350 and/or disaster risk estimate data 352 based upon the property characteristics and their condition.

[0066] In some implementations, a user of a particular client computing system 306 submits a request to the system 302 through a graphical user interface supplied by a graphical user interface engine 334. The request, for example, may include at least one property identifier 340 as well as one or more property characteristics 342 and/or identification of at least one of a replacement or repair cost estimate, a disaster risk estimate, and a confirmation of repair assessment. The property identifier 340, in some examples, may include location information (e.g., address, geolocation coordinates, lot boundaries, etc.). The location information, for example, may conform with property location information 102b described in relation to FIG. 1. In other embodiments, the property identifier 340 may be a unique property identifier (e.g., number or string) used to look up property location information in a data store 310. In another embodiment, rather than submitting a property identifier, the user may submit a

unique user identifier used to look up one or more properties associated with the user (e.g., properties insured by an insurance client, properties held by an investment client, etc.).

[0067] In one example, turning to FIG. 8A, a user may identify locations of one or more properties by selecting the properties within a graphical map interface 800. A number of properties are identified within the map view user interface 800 as indicated with an associated pin, such as pin 804. The pins, in some examples, may indicate properties insured by a particular insurance carrier, a type of property (e.g., commercial, industrial, residential, etc.), and/or properties of a value range (e.g., within a range, above a threshold, etc.). The pins, for example, may be displayed based upon filtering options supplied by the user or otherwise associated with a user profile (e.g., insurance carrier identification). In a particular example, a user may select three properties associated with three dialogue bubbles 802. As illustrated, each dialogue bubble identifies a replacement value associated with the property and invites the user to review details regarding the selected property via a details control.

[0068] In some implementations, the user enters property characteristics associated with each selected property. In other implementations, the characteristics may be accessed upon identification of the property (e.g., selection of a pin identifying a property, as illustrated in FIG. 8A). For example, the property characteristics 342 may be obtained from the data store 310, as illustrated in FIG. 3. Turning to FIG. 8B, an example property characteristics user interface 820 presents building area characteristics 822 (e.g., building area 822a, stories 822b, and total building area 824c) and structure characteristics 824 (e.g., structure material 824a, construction class 824b). As described within, different or additional characteristics may vary per implementation. In some embodiments, the user may be provided the ability via the user interface 820 to edit the building area characteristics 822 and/or the structure characteristics 824, for example via an edit control 828a or 828b. For example, in the circumstance of recent development or renovation (e.g., construction of an addition), the user

may modify previously stored characteristics values. The property characteristics user interface 820, for example, may be presented to a user upon selection of a details control of one of the dialogue bubbles 802 illustrated in the user interface of FIG. 8A.

[0069] The user interface 820 further presents, in some implementations, premium characteristics 826 such as a replacement value. The premium information, for example, may relate to an insurance policy purchased for the property or parameters for insuring the property (e.g., based upon upgraded or new characteristics). The user, in some embodiments, may be provided to update the premium information via an edit control 828c.

[0070] In some implementations, upon identification of property location information, the system 302 accesses imagery of the property from the imagery source computing system(s) 304 using an image acquisition engine 336. The images can include, in some examples, a shape map (e.g., such as the shape maps 102a described in relation to FIG. 1), two-dimensional aerial imagery (e.g., such as the aerial imagery 102c described in relation to FIG. 1), three-dimensional aerial imagery (e.g., such as the aerial imagery 102c described in relation to FIG. 1), and/or terrestrial imagery (e.g., such as the terrestrial imagery 102d described in relation to FIG. 1). The images obtained by the image acquisition engine 336, in some embodiments, depend upon the property characteristic(s) identified by the user. For example, certain types of images are preferred for analyzing certain types of property characteristics. Housing siding, for example, is more easily perceived from a terrestrial image or three-dimensional aerial image than from a two-dimensional aerial image.

[0071] In some implementations, an image quality analysis and preparation engine 326 analyzes the acquired image(s) to confirm the acquired image(s) contains an adequately clear and detailed image of the property identified by the property identifier 340. In some embodiments, the image quality analysis and preparation engine 326 crops and/or resizes the acquired image(s). For example, the image quality analysis and preparation engine 326 may

extract a portion of an acquired image based upon the property (e.g., building size). In some implementations, the image quality analysis and preparation engine 326 resizes each acquired image to a standard size. The standard size, in a particular example, may be 256 by 256 pixels per image. Resizing to a standard size, for example, may increase accuracy in later classification analysis. The image quality analysis and preparation engine 326, in some embodiments, may be configured to apply corrections to the acquired image(s). For example, the image quality analysis and preparation engine 326 may be configured to adjust an aerial image from a normal orthophoto angle, to a true orthophoto version as described above.

[0072] In some implementations, the image quality analysis and preparation engine 326 uses shape outlines as part of the analysis. For example, a composite image generation engine 318 may overlay an aerial image with a shape map image, as described in relation to FIG. 5C. Using the resultant composite image, the image quality analysis and preparation engine 326 may confirm the aerial image conforms with an urban planning map or other property placement guide (e.g., navigational map data, etc.). Further, the image quality analysis and preparation engine 326 may use the overlaid shape map as a guide in determining whether an aerial image requires correction to a true orthophoto angle and/or how closely to crop the image to capture the property (and, optionally, its immediate surroundings such as its lot or a portion of the proximate neighborhood).

[0073] In some implementations, if the image quality analysis and preparation engine 326 determines that the acquired image is insufficient, the image quality analysis and preparation engine 326 may request a replacement image from the image acquisition engine 336. For example, the image acquisition engine 336 may obtain images based upon a variety of factors including, in some examples, recency of capture, resolution, cost, and/or applicability to a particular property characteristic analysis. Upon determination by the image quality analysis and preparation engine 326 that the first obtained image is insufficient, for example, the

image acquisition engine 336 may determine a next best source for obtaining an image of the property.

[0074] In some implementations, once an image has been approved (and, optionally, prepared and/or corrected) by the image quality analysis and preparation engine 326, a feature identification engine 320 extracts features from the property image(s) related to the identified property characteristics 342. In the circumstance of a fence, for example, the feature identification engine 320 may identify a perimeter enclosure or partial perimeter enclosure abutting and extending from the property as indicative of a fence.

[0075] In some implementations, upon identification of features by the feature identification engine 320, a property characteristic classification engine 322 classifies the property characteristic. For example, the features may be classified using one or more machine learning techniques as described in relation to computational stage 106 (classify features of each image) of FIG. 1. The property characteristic classification engine 322, for example, may generate property characteristics 342 representing a grouping, type, or other characterization of a particular property feature. Continuing with the particular example of a fence, the extracted features may be analyzed and classified in relation to height and/or material. Upon classifying the property characteristics, the property characteristic classifications may be stored in the data store 310 as property characteristics 342 (e.g., similar to property characteristics 110 of FIG. 1).

[0076] In some implementations, the property characteristic classification engine 322 uses characteristic profile(s) 360 in classifying property characteristics. The property characteristic classification engine 322, for example, may obtain, for each property characteristic being analyzed, a particular characteristic profile 360 from a profile data store 314. The characteristic profiles, for example, may be similar to the characteristic profiles 108 described in relation to FIG. 1.

[0077] In some implementations, the property characteristic profiles 360 are generated by a characteristic classification learning engine 328. The characteristic classification learning engine 328, for example, may generate characteristic profiles 360 through a sample data set and learning process as described, generally, in relation to FIG. 2A. In a particular example, the characteristic classification learning engine 328 may analyze JPG (lossy compression digital image standard developed by the Joint Photographic Experts Group) to recognize varying rooftop shapes.

[0078] While certain property characteristic classifications are done by analysis, in some implementations, one or more feature classifications may be obtained from previously stored property characteristics 342. For example, based upon tax records, real estate records, etc. some basic materials and structure information regarding a property may be readily available through local and/or remote database system(s). In other examples, the previously stored property characteristics 342 may also be obtained from previous condition assessments performed for a property location by the system 302.

[0079] In some implementations, once the property characteristic classification engine 322 has classified the property characteristic(s), a characteristic condition classification engine 324 classifies the condition of each property characteristic. For example, the property characteristics may be classified as described in relation to computational stage 112 (classify condition of each feature) of FIG. 1. The characteristic condition classification engine 324, for example, may generate condition characteristics 344 representing a rating, qualification, or ranking of the condition of the particular characteristic. In some examples, the characteristic condition classification engine 324 may qualify a characteristic as a) “good” or “bad”, b) “like new”, “acceptable”, “needs repair”, or “needs replacement”, c) rated on a numeric scale such as a scale from 1 to 5 where 5 may correspond to “like new” and 1 may correspond to “needs replacement.” In other implementations, particular problems may be

identified by the characteristic condition classification engine 324 such as, in some examples, a fence feature is partially fallen, or a roof feature shows signs of structural damage.

[0080] In some implementations, the characteristic condition classification engine 324 uses condition profile(s) 362 in classifying property characteristic conditions. The characteristic condition classification engine 324, for example, may obtain, for each property characteristic being analyzed, a particular condition profile 362 from the profile data store 314. The condition profiles 362, for example, may be similar to the condition profiles 114 described in relation to FIG. 1.

[0081] In some implementations, the condition profiles 362 are generated by a condition classification learning engine 330. The condition classification learning engine 330, for example, may generate condition profiles 362 through a sample data set and learning process as described, generally, in relation to FIG. 2B. In a particular example, color histogram analysis may be used to identify peak pixel values of the images in gray scale. Using the group of calculated peak pixel values, the learning engine can classify property condition into certain categories.

[0082] In some implementations, based upon the output of the property characteristic classification engine 322 and/or the characteristic condition classification engine 324, a risk calculation engine 316 may estimate risk of damage based upon one or more types of disaster. For example, the disaster risk estimate data 352 may be calculated as described in relation to computational stage 120 (calculate damage risk) of FIG. 1. The disaster risk estimate data 350, in one example, can include a percentage likelihood of damage due to each particular type of risk based upon the particular property characteristics and/or property conditions, as described in relation to the risk estimates 122 of FIG. 1. Further, in some embodiments, the disaster risk estimate data 350 may include a set of risk estimates based upon, in some examples, a number of severities of disaster, a particular path of disaster,

and/or hazard intensity of disaster. The disaster severities, in some examples, may correspond to the Richter scale of seismic activity magnitude or the Saffir-Simpson Hurricane Wind Scale category. The path of the disaster, in some examples, can include geographical direction such as northeasterly, etc. or angle of impact with respect to the property characteristic(s). The hazard intensity of disaster, in some examples, can relate to wind speed or rainfall amount. Repair costs, for example, may be more accurately estimated when the roof condition is known. Due to poor condition of a rooftop in one particular example, the roof may be more vulnerable to damage requiring replacement. In another particular example, due to a poor condition rooftop, the likelihood for interior property damage (e.g., water damage due to breach of the roof) may increase at a set level of severity of disaster and above.

[0083] In some embodiments, the risk calculation engine 316 accesses one or more risk profiles 364 from the data store 314 based upon property characteristics and/or condition characteristics. The risk profiles, for example, may be similar to the disaster risk profiles 118 described in relation to FIG. 1. The risk profiles 364, for example, may be obtained from one or more risk data sources 306 by a cost and risk data acquisition engine 338. In other embodiments, the system 302 may generate risk profiles 364 (e.g., using risk data obtained from one or more cost and risk data sources 306 and a risk data analysis engine (not illustrated)).

[0084] The risk estimate data 352, in some embodiments, is shared with one or more clients 306. For example, an insurance carrier client 306 may use risk estimate data in making insurance assessments. In another example, a real estate investment broker or firm client 306 may apply risk estimate data 352 when selecting investment properties for an investment portfolio.

[0085] Turning to FIG. 8C, an example disaster risk user interface 840 presents risk assessment information based upon risk profiles 364 related to the selected property (e.g., one of the properties identified via the dialogue bubbles 802c of FIG. 8A). The user interface 840, for example, may be accessed by scrolling downward from the user interface 820. The user interface 840 illustrates a number of disaster risk factors 842 and associated risk estimate data 844 for the selected property. As illustrated, the disaster risk factors 842 include a fire factor 842a, a wind factor 842b, a flood factor 842c, an earthquake factor 842d, a tsunami factor 842e, and a landslide factor 842f. In some embodiments, only a subset of the risk estimate data is determined via risk assessment techniques described herein. For example, flood data 844c may be generated based upon governmental flood map evaluation rather than via aerial imaging assessment, while fire risk 844a may be determined at least in part based upon proximity to neighboring properties as derived via imaging analysis and/or construction properties derived via image analysis. Further, wind risk data 842b may be derived via rooftop analysis as described in greater detail herein.

[0086] In some implementations, based upon the output of the property characteristic classification engine 322 and/or the characteristic condition classification engine 324, a cost calculation engine 336 calculates repair or replacement costs for improving problems identified by the characteristic condition classification engine 324 and generates replacement cost estimate data 350. For example, the replacement cost estimate data 352 may be calculated as described in relation to computational stage 126 (calculate repair or replacement costs) of FIG. 1. The replacement cost estimate data 350, for example, may be similar to the cost estimates 128 described in relation to FIG. 1.

[0087] In some implementations, the cost calculation engine 336 based calculations in part on one or more cost profiles 366 (e.g., similar to the cost profiles 120 of FIG. 1). In some embodiments, the cost calculation engine 336 accesses one or more cost profiles 366 from the

data store 314 based upon property characteristics and/or condition characteristics. The cost profiles 366, in some embodiments, are obtained from one or more cost data sources 306 by the cost and risk data acquisition engine 338. In other embodiments, the system 302 may generate cost profiles 366 (e.g., by a cost data analysis engine (not illustrated) using cost data obtained from one or more cost and risk data sources 306).

[0088] The cost estimate data 350, in some embodiments, is shared with one or more clients 306. For example, an insurance carrier client 306 may use cost estimate data in determining adequacy of insurance coverage for a particular property. In another example, a real estate investment broker or real estate investment firm client 306 may apply cost estimate data 350 in determining cost of maintaining/upgrading a particular investment property.

[0089] In some implementations, the cost estimate data 350 and/or risk estimate data 352 is provided to a requesting client 306, responsive to receiving identification of one or more properties, in real-time or near real-time. For example, a client 306 accessing a dashboard interface, may format a request for a risk estimate or cost estimate related to an identified property within a dashboard interface and submit the request via a network to the system 302. Responsive to the request, the system 302 may conduct the analysis described generally above and respond, in real time or near-real time to the client 306 with a risk analysis or cost analysis. For example, risk analysis information is presented in user interface 840 of FIG. 8C.

[0090] In some implementations, the system may identify, through updated meteorological data, one or more properties within a client real estate portfolio affected by a disaster. The system, further to identification of the affected properties, may proactively prepare a repair estimate to provide to the client corresponding to the real estate portfolio shortly after the disaster took effect. In one example, the Japan Meteorological Agency may update observation data via a web site interface within an hour or so of observation. In this example,

the system may provide repair cost estimates to clients between one and two hours after a disaster has taken place.

[0091] Rather than sharing cost estimate data 350 and/or risk estimate data 352 directly with the clients 306, in other embodiments, the system 302 may include a report generation engine (not illustrated) that prepares reports regarding condition, damage, and risk assessments of one or more properties. Further, in some embodiments, the system 302 may compare a current condition characteristic 344 to a historic condition characteristic 344 to confirm whether a property owner made repairs to a property (e.g., based upon payment of an insurance claim), replaced one or more features of a property, or removed one or more features of a property (e.g., removed a hazardous collapsing structure, cut back brush encroaching a fire risk distance to a home, etc.). In another illustration, the system 302 may compare a current condition characteristic 344 to a historic condition characteristic 344 to determine whether a repair or replacement is an upgrade (e.g., replacement using superior materials) or a downgrade (e.g., replacing an in-ground pool with an above-ground pool) to the property characteristic. Other modifications of the system 302 are possible.

[0092] FIG. 4 is a flow chart of an example method 400 for classifying condition characteristics of a property based on aerial image analysis. The flow chart, for example, may represent computational stages 104 through 112 as described in relation to FIG. 1. The method 400 may be performed, for example, by the system 302 of FIG. 3.

[0093] In some implementations, the method 400 begins with accessing a two-dimensional shape map including the shape of a property (402). The shape map, for example, may be accessed by the image acquisition engine 336 from a shape map imagery source 304, as described in relation to FIG. 3. The two-dimensional shape map, for example, may take a form of any of the shape maps 102a described in relation to FIG. 1. In a particular example,

the shape map may be in a form similar to the shape map 500 described in relation to FIG.

5A.

[0094] In some implementations, two-dimensional and/or three-dimensional aerial imagery including an image of the property is accessed (404). The two-dimensional and/or three-dimensional aerial imagery, for example, may be accessed by the image acquisition engine 336 from an aerial imagery source 304, as described in relation to FIG. 3. The two-dimensional and/or three-dimensional aerial imagery, for example, may take a form of any of the aerial imagery 102c described in relation to FIG. 1. In a particular example, the two-dimensional aerial imagery may be in a form similar to the aerial image 510 described in relation to FIG. 5B.

[0095] In some implementations, the aerial imagery is overlaid with the shape map (406). The composite image generation engine 318 of FIG. 3, for example, may overlay the aerial imagery with the shape map to generate a composite image. The composite image, for example, may be in a form similar to the composite image 520 described in relation to FIG. 5C.

[0096] If a shape match is not identified (408), in some implementations, the method 400 accesses alternate two-dimensional or three-dimensional aerial imagery (410). In some embodiments, the image quality analysis and preparation engine 326 of FIG. 3 determines whether the composite image presents an adequate shape match of the property(s) of interest. Upon determining the image does not match, the image acquisition engine 336 of FIG. 3, for example, may obtain an alternative two-dimensional or three-dimensional aerial image from the aerial imagery source(s) 304. As described in relation to FIG. 3, for example, For the image acquisition engine 336 may determine a next best source for obtaining an image of the property based upon one or more factors. Conversely, the method 400, in other

implementations (not illustrated), could proceed without matching the shape map to the aerial imagery.

[0097] If a shape match is identified (408), in some implementations, the formatting of the aerial imagery is prepared (411). In some embodiments, the image is cropped to include the property of interest or the property of interest plus a portion of its surroundings (e.g., the lot containing the property and/or a portion of the proximate neighborhood in which the property resides). Cropping may be based, for example, on the correlation of the shape map to the property. In illustration, the image may be cropped to include the shape map outline of the property plus a border region. In some embodiments, cropping may include cropping to a set shape (e.g., X by X pixels square, X by Y pixels rectangle, etc.). In some embodiments, in addition to cropping the image, the image may be resized. For example, depending upon the resolution of the aerial imagery, the image resolution may be reduced, for example, to fit within an X by X pixels square or an X by Y pixels rectangle. Resizing to a standard image size, for example, can contribute to analysis consistency and improvement in classification accuracy. In further embodiments, the color depth and/or color mapping of the aerial imagery may be adjusted. For consistent color histogram analysis of the imagery, for example, the color depth and color mapping may be made consistent across analyzed images. In a particular example, color images may be converted to grayscale for grayscale image analysis. Adjustments to the imagery, for example, may be effected by the image quality analysis and preparation engine 326, described in relation to FIG. 3.

[0098] In some implementations, orthogonality of the aerial imagery is assessed (412). For example, the image quality analysis and preparation engine 326 may assess orthogonality of the aerial imagery. The image quality analysis and preparation engine 326, in one example, may determine that orthogonality correction is desired. In another example, if the image represents a normal orthophoto rather than a true orthophoto, the image quality analysis and

preparation engine 326 may notify further modules which may compensate for the angle of capture of the aerial image. In other implementations (not illustrated), orthogonality may be assessed without use of an overlaid shape map.

[0099] Returning to FIG. 4, in some implementations, if the aerial imagery is not orthogonal (414), an orthogonal version of the aerial imagery is generated (416). The image quality analysis and preparation engine 326 of FIG. 3, for example, may correct a normal orthophoto form to generate a true orthophoto form. The true orthophoto form, for example, may better match the shape map overly.

[0100] In some implementations, one or more property characteristics of the property are classified (418). The property, in some embodiments, is analyzed based on the portion of the aerial image substantially bounded by the shape map of the property. In other embodiments, the property analysis encompasses a surrounding of the property (e.g., features proximate the property upon the property lot, nearby properties, etc.). The property characteristic(s), for example, may be classified by the property characteristic classification engine 322, as described in relation to FIG. 3. In a particular example, a rooftop property feature may be classified as one of a variety of rooftop shapes, as illustrated in FIG. 2A.

[0101] In some implementations, if a property characteristic classification is identified (420), a condition of each of the property characteristics can be classified (422). The property characteristic condition(s), for example, may be classified by the characteristic condition classification engine 324, as described in relation to FIG. 3. In a particular example, a hipped classification of the rooftop feature may be classified as one of a good condition and a poor condition, as illustrated in FIG. 2B. In some implementations, the classifications of the condition of each of the property characteristics may be output to a computing device of a requester (424) via a dashboard interface screen. In some examples, in addition to providing the condition classification for the property characteristics, the dashboard interface screen

may include replacement costs for replacing the property characteristics, risk cost estimates due to damage from natural disasters, or confirmation of whether or not repairs have been made to the property characteristics.

[0102] If, instead, a classification match was not identified (420), in some implementations, alternate two-dimensional or three-dimensional aerial imagery is accessed (410) and the method 400 restarts with overlaying the replacement aerial imagery with the shape map (406). Alternatively, in some embodiments, even if a classification match is not identified, condition may be assessed based upon a default profile associated with the property feature (not illustrated). For example, if the rooftop shape does not match one of the shapes trained into the system, the condition of the rooftop may still be assessed based upon a general condition profile trained with a variety of rooftop shapes. In some examples, the condition of the rooftop may be assessed by comparing the current rooftop conditions to stored historic condition characteristics for the property from a previous condition assessment.

[0103] Although the method 400 is illustrated as a series of steps, in other implementations, more or fewer steps may be included. For example, in some implementations, terrestrial images are obtained and used to classify the same and/or different property characteristics, as described in relation to the operational flow 100 of FIG. 1.

[0104] Additionally, in other implementations, certain steps may be performed in a different order. For example, in some implementations, property characteristics and condition characteristics may be classified (418, 422) in parallel. Other modifications of the operational flow 100 are possible.

[0105] Aspects of the present disclosure may be directed to computing systems for categorizing a repair condition of a property characteristic in order to provide dynamic, real-time property condition assessments in response to requests received from users such as insurance carriers or real estate investment brokers using aerial imagery. The

implementations described herein improve upon conventional methodologies by applying deep learning analysis models to detected property characteristics of the obtained imagery in order to assess whether a condition of the property characteristics is degraded to a point of needing repair or replacement and determine an amount of risk exposure of the property due to the detected condition of the property characteristics. The implementations described herein improve processing efficiency of the system to reduce an amount of time it takes to perform the condition assessments and automate a condition assessment process.

[0106] Next, a hardware description of the computing device, mobile computing device, or server according to exemplary embodiments is described with reference to Figure 6. In Figure 6, the computing device, mobile computing device, or server includes a CPU 600 which performs the processes described above. The process data and instructions may be stored in memory 602. These processes and instructions may also be stored on a storage medium disk 604 such as a hard drive (HDD) or portable storage medium or may be stored remotely. Further, the claimed advancements are not limited by the form of the computer-readable media on which the instructions of the inventive process are stored. For example, the instructions may be stored on CDs, DVDs, in FLASH memory, RAM, ROM, PROM, EPROM, EEPROM, hard disk or any other information processing device with which the computing device, mobile computing device, or server communicates, such as a server or computer.

[0107] Further, a portion of the claimed advancements may be provided as a utility application, background daemon, or component of an operating system, or combination thereof, executing in conjunction with CPU 600 and an operating system such as Microsoft Windows 6, UNIX, Solaris, LINUX, Apple MAC-OS and other systems known to those skilled in the art.

[0108] CPU 600 may be a Xenon or Core processor from Intel of America or an Opteron processor from AMD of America, or may be other processor types that would be recognized by one of ordinary skill in the art. Alternatively, the CPU 600 may be implemented on an FPGA, ASIC, PLD or using discrete logic circuits, as one of ordinary skill in the art would recognize. Further, CPU 600 may be implemented as multiple processors cooperatively working in parallel to perform the instructions of the inventive processes described above.

[0109] The computing device, mobile computing device, or server in FIG. 6 also includes a network controller 606, such as an Intel Ethernet PRO network interface card from Intel Corporation of America, for interfacing with network 6X. As can be appreciated, the network 628 can be a public network, such as the Internet, or a private network such as an LAN or WAN network, or any combination thereof and can also include PSTN or ISDN sub-networks. The network 628 can also be wired, such as an Ethernet network, or can be wireless such as a cellular network including EDGE, 3G and 4G wireless cellular systems. The wireless network can also be Wi-Fi, Bluetooth, or any other wireless form of communication that is known.

[0110] The computing device, mobile computing device, or server further includes a display controller 608, such as a NVIDIA GeForce GTX or Quadro graphics adaptor from NVIDIA Corporation of America for interfacing with display 610, such as a Hewlett Packard HPL2445w LCD monitor. A general purpose I/O interface 612 interfaces with a keyboard and/or mouse 614 as well as a touch screen panel 616 on or separate from display 610. General purpose I/O interface also connects to a variety of peripherals 618 including printers and scanners, such as an OfficeJet or DeskJet from Hewlett Packard.

[0111] A sound controller 620 is also provided in the computing device, mobile computing device, or server, such as Sound Blaster X-Fi Titanium from Creative, to interface with speakers/microphone 622 thereby providing sounds and/or music.

[0112] The general purpose storage controller 624 connects the storage medium disk 604 with communication bus 626, which may be an ISA, EISA, VESA, PCI, or similar, for interconnecting all of the components of the computing device, mobile computing device, or server. A description of the general features and functionality of the display 610, keyboard and/or mouse 614, as well as the display controller 608, storage controller 624, network controller 606, sound controller 620, and general purpose I/O interface 612 is omitted herein for brevity as these features are known.

[0113] One or more processors can be utilized to implement various functions and/or algorithms described herein, unless explicitly stated otherwise. Additionally, any functions and/or algorithms described herein, unless explicitly stated otherwise, can be performed upon one or more virtual processors, for example on one or more physical computing systems such as a computer farm or a cloud drive.

[0114] Reference has been made to flowchart illustrations and block diagrams of methods, systems and computer program products according to implementations of this disclosure. Aspects thereof are implemented by computer program instructions. These computer program instructions may be provided to a processor of a general purpose computer, special purpose computer, or other programmable data processing apparatus to produce a machine, such that the instructions, which execute via the processor of the computer or other programmable data processing apparatus, create means for implementing the functions/acts specified in the flowchart and/or block diagram block or blocks.

[0115] These computer program instructions may also be stored in a computer-readable medium that can direct a computer or other programmable data processing apparatus to function in a particular manner, such that the instructions stored in the computer-readable medium produce an article of manufacture including instruction means which implement the function/act specified in the flowchart and/or block diagram block or blocks.

[0116] The computer program instructions may also be loaded onto a computer or other programmable data processing apparatus to cause a series of operational steps to be performed on the computer or other programmable apparatus to produce a computer implemented process such that the instructions which execute on the computer or other programmable apparatus provide processes for implementing the functions/acts specified in the flowchart and/or block diagram block or blocks.

[0117] Moreover, the present disclosure is not limited to the specific circuit elements described herein, nor is the present disclosure limited to the specific sizing and classification of these elements. For example, the skilled artisan will appreciate that the circuitry described herein may be adapted based on changes on battery sizing and chemistry, or based on the requirements of the intended back-up load to be powered.

[0118] The functions and features described herein may also be executed by various distributed components of a system. For example, one or more processors may execute these system functions, where the processors are distributed across multiple components communicating in a network. The distributed components may include one or more client and server machines, which may share processing, as shown on Fig. 8, in addition to various human interface and communication devices (e.g., display monitors, smart phones, tablets, personal digital assistants (PDAs)). The network may be a private network, such as a LAN or WAN, or may be a public network, such as the Internet. Input to the system may be received via direct user input and received remotely either in real-time or as a batch process. Additionally, some implementations may be performed on modules or hardware not identical to those described. Accordingly, other implementations are within the scope that may be claimed.

[0119] In some implementations, as illustrated in FIG. 7, the innovations described herein may interface with a cloud computing environment 730, such as Google Cloud Platform™ to

perform at least portions of methods or algorithms detailed above. The processes associated with the methods described herein can be executed on a computation processor, such as the Google Compute Engine by data center 734. The data center 734, for example, can also include an application processor, such as the Google App Engine, that can be used as the interface with the systems described herein to receive data and output corresponding information. The cloud computing environment 730 may also include one or more databases 738 or other data storage, such as cloud storage and a query database. In some implementations, the cloud storage database 738, such as the Google Cloud Storage, may store processed and unprocessed data supplied by systems described herein.

[0120] The systems described herein may communicate with the cloud computing environment 730 through a secure gateway 732. In some implementations, the secure gateway 732 includes a database querying interface, such as the Google BigQuery platform.

[0121] The cloud computing environment 102 may include a provisioning tool 740 for resource management. The provisioning tool 740 may be connected to the computing devices of a data center 734 to facilitate the provision of computing resources of the data center 734. The provisioning tool 740 may receive a request for a computing resource via the secure gateway 732 or a cloud controller 736. The provisioning tool 740 may facilitate a connection to a particular computing device of the data center 734.

[0122] A network 702 represents one or more networks, such as the Internet, connecting the cloud environment 730 to a number of client devices such as, in some examples, a cellular telephone 710, a tablet computer 712, a mobile computing device 714, and a desktop computing device 716. The network 702 can also communicate via wireless networks using a variety of mobile network services 720 such as Wi-Fi, Bluetooth, cellular networks including EDGE, 3G and 4G wireless cellular systems, or any other wireless form of communication that is known. In some embodiments, the network 702 is agnostic to local interfaces and

networks associated with the client devices to allow for integration of the local interfaces and networks configured to perform the processes described herein.

[0123] While certain embodiments have been described, these embodiments have been presented by way of example only, and are not intended to limit the scope of the present disclosures. Indeed, the novel methods, apparatuses and systems described herein can be embodied in a variety of other forms; furthermore, various omissions, substitutions and changes in the form of the methods, apparatuses and systems described herein can be made without departing from the spirit of the present disclosures. The accompanying claims and their equivalents are intended to cover such forms or modifications as would fall within the scope and spirit of the present disclosures.

CLAIMS

What is claimed is:

1. A method for automatically categorizing a condition of a characteristic of a property, the method comprising:
 - obtaining, by processing circuitry, an aerial image of a geographic region including the property;
 - extracting, by the processing circuitry, one or more features of a plurality of features from the aerial image, wherein
 - the one or more features are each represented by a set of pixel groupings, and
 - the one or more features represent the characteristic of the property, wherein
 - each pixel grouping of the set of pixel groupings comprises at least one of angles, outlines, or substantially homogenous pixel fields;
 - applying, by the processing circuitry, a first portion of the set of pixel groupings to a first machine learning classifier to determine a characteristic classification of the characteristic from a plurality of potential classifications of the characteristic, wherein
 - the first machine learning classifier is trained to identify at least a portion of the one or more features from the first portion of the set of pixel groupings; and
 - applying, by the processing circuitry, a second portion of the set of pixel groupings to a second machine learning classifier to determine a condition classification of the characteristic from a plurality of potential condition classifications of the characteristic, wherein
 - the second machine learning classifier is trained to identify, from the second portion of the set of pixel groupings, property characteristic conditions of the characteristic having the characteristic classification.

2. The method of claim 1, further comprising comparing, by the processing circuitry, the condition classification to a historic condition classification to identify a change in condition of the characteristic of the property.
3. The method of claim 1, further comprising preparing, by the processing circuitry for presentation to a user, a graphical report comprising condition information regarding the condition classification.
4. The method of claim 3, wherein the preparing comprises preparing the graphical report as an interactive user interface.
5. The method of claim 1, wherein at least one of the first machine learning classifier or the second machine learning classifier comprises a CNN model.
6. The method of claim 1, wherein the plurality of potential condition classifications comprises a numeric scale of condition classifications ranging between a needs replacement condition and a like new condition.
7. The method of claim 1, further comprising determining, by the processing circuitry based in part on the characteristic classification and the condition classification, a cost for repair or replacement of the characteristic of the property.
8. The method of claim 1, further comprising determining, by the processing circuitry based in part on the characteristic classification and the condition classification, a risk estimate of damage to the characteristic of the property due to one or more disasters.

9. A system for automatically categorizing a condition of a property feature of a property, the system comprising:

- a non-transitory computer readable storage region storing

- a first machine learning analysis model trained to identify one or more property characteristics, and

- a second machine learning analysis model trained to identify one or more property conditions;

- processing circuitry; and

- a non-transitory computer readable medium having instructions stored thereon;

- wherein the instructions, when executed by the processing circuitry, cause the processing circuitry to

- extract a set of image-related features from an aerial image, wherein the set of image-related features represent the property feature;

- apply the first portion of the set of image-related features to the first machine learning analysis model to determine a characteristic classification of the property feature from a plurality of potential characteristic classifications of the property feature; and

- apply the second portion of the image-related features to the second machine learning analysis model to determine a condition classification of the property feature from a plurality of potential condition classifications of the property feature, wherein

- the second machine learning analysis model is trained to identify, from the second portion of the set of image-related features, property

characteristic conditions of the property feature having the
characteristic classification.

10. The system of claim 9, wherein each image-related feature of the set of image-related features comprises at least one of angles, outlines, or substantially homogenous pixel fields.

11. The system of claim 9, wherein the instructions, when executed by the processing circuitry, cause the processing circuitry to, prior to extracting the set of image-related, assess orthogonality of the aerial image.

12. The system of claim 11, wherein the instructions, when executed by the processing circuitry, cause the processing circuitry to, responsive to assessing that the orthogonality of the aerial image does not correspond to a true orthophoto form, cause correction of the aerial image to the true orthophoto form.

13. The system of claim 9, wherein the instructions, when executed by the processing circuitry, cause the processing circuitry to obtain, via a network from a remote computing system, the aerial image of the geographic area.

14. The system of claim 13, wherein the instructions, when executed by the processing circuitry, cause the processing circuitry to, prior to obtaining the aerial image, determine, based at least in part on the property feature, a preferred image type corresponding to the characteristic classification.

15. The system of claim 9, wherein the plurality of potential characteristic classifications comprises at least one of a plurality of potential sizes, a plurality of potential shapes, or a plurality of potential materials of the characteristic of the property.
16. A non-transitory computer readable medium having instructions stored thereon, wherein the instructions, when executed by processing circuitry, cause the processing circuitry to:
- obtain aerial and/or terrestrial imagery including a property;
 - extract a plurality of pixel groupings from the aerial and/or terrestrial imagery, wherein
 - the plurality of pixel groupings includes a respective set of pixel groupings
 - representative of each feature of one or more features of the property, wherein
 - each pixel grouping of the set of pixel groupings comprises at least one of
 - angles, outlines, or substantially homogenous pixel fields; and
 - determine at least one characteristic and at least one condition of the property, wherein
 - determining comprises, for each feature of the one or more features of the property,
 - apply at least a portion of the one or more sets of pixel groupings corresponding to the
 - respective feature to one or more first machine learning classifiers trained to
 - identify one or more characteristics of the respective feature, and
 - apply at least a portion of the one or more sets of of pixel groupings corresponding to
 - the respective feature to one or more second machine learning classifiers trained
 - to identify a condition of the respective feature in view of at least a first
 - characteristic of the one or more characteristics.
17. The non-transitory computer readable medium of claim 16, further comprising using the at least one characteristic and the at least one condition, determine one or more of a risk estimate, a repair estimate, and a replacement estimate.

18. The non-transitory computer readable medium of claim 17, wherein the instructions, when executed by the processing circuitry, cause the processing circuitry to access one or more known property characteristics, wherein
- determining the one or more of the damage risk estimate, the repair estimate, and the replacement estimate comprises applying, to the determining, the one or more known property characteristics.
19. The non-transitory computer readable medium of claim 16, wherein the one or more characteristics of a first feature of the one or more features comprises a shape characteristic and a material characteristic.
20. The non-transitory computer readable medium of claim 16, wherein extracting the plurality of pixel groupings from the aerial and/or terrestrial imagery comprises extracting a first set of pixel groupings from an aerial image and a second set of pixel groupings from a terrestrial image.
21. The non-transitory computer readable medium of claim 16, wherein a first feature of the one or more features comprises a rooftop of a house, and a second feature of the one or more features comprises a structure adjacent to the house.
22. The non-transitory computer readable medium of claim 16, wherein the aerial and/or terrestrial imagery comprises a three-dimensional (3D) aerial image.

ABSTRACT

In an illustrative embodiment, methods and systems for automatically categorizing a condition of a property characteristic may include obtaining aerial imagery of a geographic region including the property, identifying features of the aerial imagery corresponding to the property characteristic, analyzing the features to determine a property characteristic classification, and analyzing a region of the aerial imagery including the property characteristic to determine a condition classification.

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

First Named Inventor:	Takeshi Okazaki	Nonprovisional Application Number (if known):	
Title of Invention:	Platform, Systems, and Methods for Identifying Property Characteristics and Property Feature Conditions Through Aerial Imagery Analysis		

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 <u>/Natalie J. Grace/</u>	Date <u>January 3, 2020</u>
Name (Print/Typed) <u>Natalie J. Grace</u>	Practitioner Registration Number <u>65803</u>
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 <u>1</u> forms are submitted.	

Privacy Act Statement

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

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

POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

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

I hereby appoint:



Practitioners associated with Customer Number:

146018

OR



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

Name	Registration Number

Name	Registration Number

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

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



The address associated with Customer Number:

146018

OR

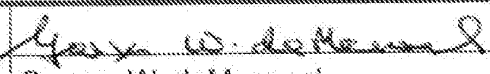
☐	Firm or Individual Name			
	Address			
	City	State	Zip	
	Country			
	Telephone	Email		

Assignee Name and Address: AON BENFIELD INC.
200 EAST RANDOLPH STREET
CHICAGO, ILLINOIS 60601

A copy of this form, together with a statement under 37 CFR 3.73(c) (Form PTO/AIA/56 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(c) may be completed by one of the practitioners appointed in this form, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

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

Signature		Date	July 13, 2017
Name	George W. deMenocal	Telephone	203.326.4379
Title	President and Chief Executive Officer - U.S.		

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 5 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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

Privacy Act Statement

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

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

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
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Electronic Acknowledgement Receipt

EFS ID:	38227539
Application Number:	16733888
International Application Number:	
Confirmation Number:	5317
Title of Invention:	Platform, Systems, and Methods for Identifying Property Characteristics and Property Feature Conditions Through Aerial Imagery Analysis
First Named Inventor/Applicant Name:	Takeshi Okazaki
Customer Number:	146018
Filer:	Natalie J. Grace/Jon Bhatt
Filer Authorized By:	Natalie J. Grace
Attorney Docket Number:	474139US02
Receipt Date:	07-JAN-2020
Filing Date:	
Time Stamp:	16:38:44
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment		no			
File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		474139US02_POA-373.pdf	1401213	yes	5
			4f823828bedfb0069df2ed984aa199419b2a6a6f		

	Multipart Description/PDF files in .zip description		
	Document Description	Start	End
	Assignee showing of ownership per 37 CFR 3.73	3	5
	Power of Attorney	1	2
Warnings:			
Information:			
Total Files Size (in bytes):		1401213	
<p>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.</p> <p><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.</p> <p><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.</p> <p><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.</p>			

STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: AON BENFIELD INC.

Application No./Patent No.: 16/733,888 Filed/Issue Date: January 3, 2020

Titled: Platform, Systems, and Methods for Identifying Property Characteristics and Property Feature Conditions Through Aerial Imagery Analysis

AON BENFIELD INC., a corporation

(Name of Assignee)

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

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

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

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

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

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

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

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

- A. ☒ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 050623, Frame 0112, or for which a copy thereof is attached.
- B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

2. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

[Page 1 of 2]

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

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 Reel _____, Frame _____, or for which a copy thereof is attached.

4. From: _____ To: _____

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

5. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
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6. From: _____ To: _____

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

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

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

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

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

/Natalie J. Grace/

January 7, 2020

Signature

Date

Natalie J. Grace

65,803

Printed or Typed Name

Title or Registration Number

Privacy Act Statement

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 16/733,888	
APPLICATION AS FILED - PART I							
(Column 1)		(Column 2)		SMALL ENTITY		OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)
BASIC FEE <small>(37 CFR 1.16(a), (b), or (c))</small>	N/A	N/A	N/A			N/A	300
SEARCH FEE <small>(37 CFR 1.16(k), (l), or (m))</small>	N/A	N/A	N/A			N/A	660
EXAMINATION FEE <small>(37 CFR 1.16(o), (p), or (q))</small>	N/A	N/A	N/A			N/A	760
TOTAL CLAIMS <small>(37 CFR 1.16(i))</small>	22	minus 20 = *				x 100 =	200
INDEPENDENT CLAIMS <small>(37 CFR 1.16(h))</small>	3	minus 3 = *				x 460 =	0.00
APPLICATION SIZE FEE <small>(37 CFR 1.16(s))</small>	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 <small>(37 CFR 1.16(j))</small>							0.00
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL		TOTAL	1920
APPLICATION AS AMENDED - PART II							
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY	
AMENDMENT A	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)
	Total <small>(37 CFR 1.16(i))</small>	*	Minus **	=	x =		x =
	Independent <small>(37 CFR 1.16(h))</small>	*	Minus ***	=	x =		x =
	Application Size Fee <small>(37 CFR 1.16(s))</small>						
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM <small>(37 CFR 1.16(j))</small>						
				TOTAL ADD'L FEE		TOTAL ADD'L FEE	
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY	
AMENDMENT B	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)
	Total <small>(37 CFR 1.16(i))</small>	*	Minus **	=	x =		x =
	Independent <small>(37 CFR 1.16(h))</small>	*	Minus ***	=	x =		x =
	Application Size Fee <small>(37 CFR 1.16(s))</small>						
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM <small>(37 CFR 1.16(j))</small>						
				TOTAL ADD'L FEE		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.							



UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
16/733,888	01/03/2020	2668	1920	474139US02	22	3

CONFIRMATION NO. 5317

FILING RECEIPT

146018
Gardella Grace P.A.
80 M Street SE, 1st Floor
Washington, DC 20003



0000000114195837

Date Mailed: 01/28/2020

Receipt is acknowledged of this non-provisional utility patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

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Inventor(s)

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Applicant(s)

Aon Benfield Inc., Chicago, IL

Assignment For Published Patent Application

Aon Benfield Inc., Chicago, IL

Power of Attorney: The patent practitioners associated with Customer Number 146018

Domestic Priority data as claimed by applicant

This application is a CIP of 15/714,376 09/25/2017 PAT 10529029
which claims benefit of 62/398,665 09/23/2016

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.

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Projected Publication Date: 05/07/2020

Non-Publication Request: No

Early Publication Request: No

Title

Platform, Systems, and Methods for Identifying Property Characteristics and Property Feature
Conditions Through Aerial Imagery Analysis

Preliminary Class

382

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	Filing Date	2020-01-03
	First Named Inventor	Takeshi Okazaki
	Art Unit	3694
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	1	KERLE, et al., Urban Structural Damage Assessment With Oblique UAV Imagery, Object-Based Image Analysis And Semantic Reasoning, 35th Asian Conference On Remote Sensing, October 27, 2014.	
	2	NIA, et al., Building Damage Assessment Using Deep Learning and Ground-Level Image Data, 2017 14th Conference on Computer and Robot Vision (CRV), May 16, 2017, pages 95-102.	
	3	RAKHA, et al., Review Of Unmanned Aerial System (UAS) Applications In The Built Environment: Towards Automated Building Inspection Procedures Using Drones, Automation in Constructions 93, September 1, 2018, pages 252-264.	
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	6	BUSCOMBE, et al., Landscape Classification With Deep Neural Networks, Geosciences, Volume 8, Issue 7, July 2018, page 244.	
	7	SHEPPARD, et al., Real-Time Scene Understanding For UAV Imagery Based On Deep Convolutional Neural Networks, 2017 IEEE International Geoscience And Remote Sensing Symposium (IGARSS), July 23, 2017, pages 2243-2246.	

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8	"Drones Above: Meet the Flying Superintendent!" BuildWorlds. Accessed on January 16, 2020. 6 pages. < https://builtworlds.com/news/drones-meet-flying-superintendent/ >
9	ZHANG, et al., Thermal Infrared Inspection Of Roof Insulation Using Unmanned Aerial Vehicles, The International Archives Of The Photogrammetry, Remote Sensing And Spatial Informational Sciences, Volume 40-Number 1, September 2, 2015.
10	HAM, et al., Visual Monitoring Of Civil Infrastructure Systems Via Camera-Equipped Unmanned Aerial Vehicles (UAVs): A Review Of Related Works, Visualization In Engineering 4, Article 1 (2016), December 2016.
11	YE, et al., Automated Detection Of Damaged Areas After Hurricane Sandy Using Aerial Color Images, Computing In Civil And Building Engineering, June 17, 2014, pages 1796-1803.

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(54) Title: FLOOD RISK MAPPING AND WARNING SYSTEM AND METHOD

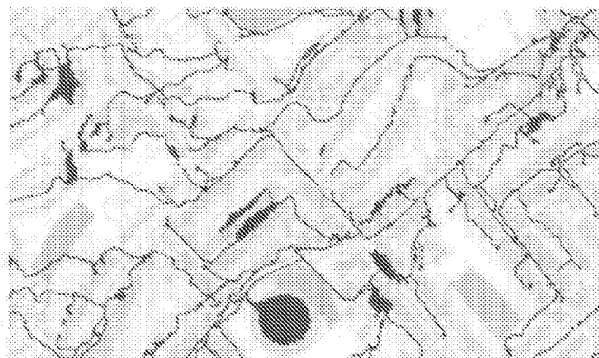


Fig. 3

(57) Abstract: A system and method are disclosed which can provide pluvial hazard predictions over large scale areas and which can be regularly updated to take into account topographical changes over time as well as planned changes. The system uses a plural -ity of different data inputs for analysing and extracting data relating to elements which may contribute to water flow changes includ -ing for instance curbs, hedges, walls, buildings and so on. The system and method can be used for a variety of other applications oth -er than pluvial hazard detection and prediction.

WO 2016/198873 A1

FLOOD RISK MAPPING AND WARNING SYSTEM AND METHOD

Field of the Invention

5 The present invention relates to a system and method for mapping flood risk and for warning of flood risk in one or more zones. The system and method disclosed herein is not restricted to flood prediction as they can be used for a variety of other applications including, for example, revenue assurance and leakage detection by utility companies, specifically water supply and removal
10 companies; as well as for other non-water relates uses some of which are indicated below.

Background of the Invention

15 Flooding is a phenomenon which is experienced in many countries and has devastating consequences on inhabitants and businesses. Environmental changes are also bringing flooding to areas not previously affected and increasing flooding to flood prone zones.

 It is historically difficult to determine the likelihood of flooding in a zone,
20 such as in towns or streets, and various studies have sought to address this. Of importance are the reliefs created by structures within a zone, for example a road or network of roads, buildings and so on, which may affect the flow of surface water within the zone. Examples of studies in this field include: Overland Flow and Pathway Analysis for Modelling of Urban Pluvial Flooding, Professor Cedo Maksimovic *et al*, in Journal of Hydraulic Research Vol. 47, No. 4 (2009), pp. 512-
25 523 of the International Association of Hydraulic Engineering and Research; and "Urban Drainage Models for Flood Forecasting: 1D/1D, 1D/2D and Hybrid Models", N Simoes *et al*, at the 12th International Conference on Urban Drainage, Porto Alegre/Brazil, 11-16 September 2011. While these studies discuss
30 methodologies for seeking to determine risk of flooding in a built-up zone, difficulties arise with scaling these theories beyond confined areas and as a consequence have to date failed to find widespread application. These trials also

do not and are not able to address many of the topographical elements which contribute to flood risk.

Summary of the Present Invention

5

The present invention seeks to provide a system and method for determining the risk of flooding in a zone and to a method of warning of flooding risk. The present invention also seeks to provide a system and method for predicting other climactic, water based and topographical events.

10 According to an aspect of the present invention, there is provided a method of determining risk of an environmental event in a zone caused by an environmental element, including the steps of:

obtaining zone data from a plurality of sources including at least one cartographical map and at least one plan view image of the zone;

15 superimposing the data from the plurality of sources to form a combined data map;

determining from the combined data map the nature and location of obstacles to the environmental element;

20 determining from the determined obstacles a likely path of movement of the environmental element in the zone; and

determining from the determined path one or more areas in the zone at risk of an environmental event.

Typically, the environmental effect may be flooding.

25 The use of an image provides data relating to possible obstacles to water which are not readily determined by a cartographical map, such as fences, walls, kerbsides and so on, which may not appear at all on such a map. The combined data map can therefore provide a much more accurate indication of obstacles to the path of ground surface water than cartographical maps alone.

30 In one embodiment, the method includes the step of obtaining at least an aerial image, which in practice is preferably a visual image of the zone. In other embodiments, the image includes either or in addition a perspective or elevational image of at least a part of the zone. An image in plan can be superimposed

directly, often after normalisation of the image data, with a cartographical map, with the image being used to identify features indicative of obstacles not on the cartographical map. A perspective or elevational view can also be used in conjunction with a cartographical map to identify such obstacles and in the case
5 where both a plan view image and an elevational or perspective image are used, the elevational or perspective view can be used to verify the existence and nature of obstacles, such as walls, kerbs, steps and so on, which might not be apparent from a plan view image.

The plan view image in the preferred embodiment is obtained from LIDAR
10 data. The cartographical map is preferably a high quality map, in the United Kingdom advantageously an Ordinance Survey map or similar map.

In an embodiment, the method also includes the step of obtaining land registry data indicative of planned or completed building works in the zone and combining the land registry data with the cartographical map and visual image
15 data into the combined data map. Use of such data can provide an additional indication and verification of obstacles as well as potential obstacles. This data can also be used in a predictive assessment to provide advance warning of the effect of intended or planned obstacles on flood risk, for example by planned roads, buildings, walls and so on.

The land registry data can also provide, for instance by reference to
20 planning data relating to intended works, information useful in determining which area or areas of a zone are likely to change and as a result which parts of the combined data map may need updating over time. This can significantly reduce the amount of data processing required to keep the combined data map
25 up-to-date.

Advantageously, the method includes the step of obtaining street sewer location data, the combined data map including said sewer location data. The method may include the step of determining topographical data of the zone, the combined data map including said topographical data.

The method preferably includes the step of generating a warning indicator
30 relating to the determined risk of flooding, advantageously a visual flood risk indicator. This may be a coloured indicator, for instance providing a plurality of

different colours, each indicative of a level of determined risk. In an example, the different colours may include a red indication for a determined high risk of flooding, green for a determined low risk of flooding and amber for a determined intermediate risk of flooding.

5 A system to implement the method includes a processor unit including a plurality of input/output elements able to be coupled to respective sources of data, and an output unit operable to indicate flood risk in a zone. The output unit may include a visual warning, in the preferred embodiment a light colour warning, such as red for high flood risk, amber for medium flood risk and green for low colour
10 risk.

According to an aspect of the present invention, there is provided a system for determining risk of an environmental event in a zone caused by an environmental element, including:

an input unit configured to obtain zone data from a plurality of sources
15 including at least one cartographical map and at least one plan view image of the zone;

a processing unit for superimposing the data from the plurality of sources to form a combined data map, for determining from the combined data map the nature and location of obstacles to the environmental element, for determining
20 from the determined obstacles a likely path of movement of the environmental element in the zone, and for determining from the determined path one or more areas in the zone at risk of an environmental event.

The system and method disclosed herein can provide a combine data map closely representative of the obstacles to ground surface water flow in a zone,
25 better able to determine flood risk. The system is able to be scaled up to cover very large areas, including whole countries and continents, by selective use of data and also by integrating within the data indications of changes or planned in obstacles in a zone, thereby allowing focusing of data processing to those areas of change. In particular, the combined data map may be updated by using planning
30 applications, information of byways and changes to satellite or aerial photographs over time and determining where the changes are.

Brief Description of the Drawings

Embodiments of the present invention are described below, by way of example only, with reference to the accompanying drawings, in which:

5 Figure 1 is a flow chart of a preferred method of determining flood risk in a zone;

 Figure 2 is a schematic diagram of the basic elements of a system as taught herein;

10 Figure 3 is a schematic map showing an example of flood prediction in a built-up area;

 Figure 4 is a map showing the generation of an enhanced DTM;

 Figure 5 is a bird's eye view of a zone for use in identifying areas of a tarmac in the zone;

15 Figure 6 shows the view of Figure 5, filtered to show enhanced detail of the zone's topography;

 Figure 7 is a satellite image showing a bridge;

 Figures 8 to 10 show the processing of LIDAR data related to the zone of Figure 7 in the processing of bridge identification;

 Figures 11 to 13 show a practical example of bridge detection;

20 Figures 14 to 16 show how hedges may be identified;

 Figures 17 to 19 show how grass/trees may be identified;

 Figures 20 to 24 show how curbs may be identified;

 Figures 25 to 29 show how walls may be identified;

 Figures 30 to 35 show how buildings may be identified;

25 Figures 36 to 41 show how calibration can be used to ensure accurate data generation;

 Figure 42 is an example of a pluvial hazard map;

 Figure 43 is a 1D-1 D model simulating street network flow and underground drainage system;

30 Figure 44 is a map showing possible flood hazards;

 Figures 45 to 48 show the combined effect of flood hazard modelling on various areas of a city;

Figure 49 is a schematic block diagram showing the primary elements of the preferred embodiment of system and method taught herein;

Figure 50 to 52 are colour charts showing colour filtering and processing for extracting data form images.

5

Description of the Preferred Embodiments

For ease of understanding the concepts and methodologies taught herein there is first provided a description of the preferred and potential sources of topographical data. Data processing methods and algorithms, needed to generate the combined data set for predicting events are also described. Specific examples of the preferred algorithms are then set out in a series of specific examples. It is to be understood that any number of the data sources may be used together, though in all embodiments it is preferred that there is at least one cartographical map and at least one plan view image of the zone depicted by the map.

15

Data Sources/Intermediary Products

LIDAR Data

The preferred embodiments use Lidar Data, which is vertical scaled data providing a 3D geometric description of the ground. It comes in various formats from various sources so the system and method taught herein normalises this data to make sure the data has a common scale and resolution with other zone data.

20

LIDAR data is preferably handled as a Digital Elevation Model (DEM) format.

25

Ordinance Survey Map Data

The preferred embodiments use Ordinance Survey (OS) Map data provided by Ordnance Survey in the UK. For other countries, other sources of map data may be used. Ordnance Survey data provides land use data (which can also be obtained from Satellite Imagery) and also boundary, road and building intersections.

30

The method and system use OS data for calculation of intersections such as bridges and tunnels which can have a significant impact on the topology of land for flooding.

5 Road network

In the preferred embodiments, data relating to the road network is processed by the following routines.

a) Filters

10 The first step in processing the road network is to apply filters to remove areas of little or no interest. This includes filtering out green areas via a colour filter and then running a blurring filter to remove small details (where only large-scale detail is of interest). Any areas which are not standard road tarmac coloured (or connected to them) are filtered out at this stage.

15

b) Edges

 The system and method then run a Sobel edge detection routine on the image, which provides a greyscale output image that shows where all the edges are detected. This removes all extraneous detail from the image and the output is
20 a grey scale image showing large feature outlines.

c) Small Features

 The output of the edge detection routine is put thorough a second filter to remove small details. The primary features of interest are lines of a certain
25 thickness or above, anything else is likely to be of no concern.

 These preliminary filters should provide an image which is almost entirely road network based.

d) Skeletonise

30 The next algorithm to run is a skeletonising algorithm. This reduces a thick network of lines down to individual lines that are a single pixel wide. From these thin lines the process then picks up all the intersection and termination points

using morphological transformations and stores both the orientation and position of those intersections.

The output is a list of intersection and termination points, with both a geographical location (expressed in local coordinate system) and an approximate orientation. That list can then be compared with the previous list from the last iteration and determine if any points have significantly moved or been added. New points or moved points indicate new road construction or road extension. The comparisons which are run preferably include checking if the number of points has changed for a defined region and using fuzzy logic to examine each individual point to see if there is one on the list that roughly maps.

Land Registry Data

Land Registry Data is provided in the United Kingdom by the Land Registry. This data comprises a set of polygon lines indicating the boundaries of properties within an area.

The method and system taught herein overlays this data over other map data and use it for two primary purposes: (a) to define where boundaries are for intersection review (in the boundary crossing algorithms) and also to seek out potential boundaries (such as walls) on satellite imagery.

Satellite Imagery

The preferred method and system use satellite imagery for two purposes. First, to verify land usage in the area (roads, green pastures and to some extent man-made structures such as buildings) and, secondly, to investigate if it is possible to determine readily whether there are obstructions to assumed water paths from walls and other such structures.

In a preferred embodiment, the method and system pre-process a satellite image to prepare it for other subroutines for later use. The process is broken down into, preferably, five separate steps as follows:

a) Satellite Image Retrieval

In this process the method and system check for the availability of satellite data for the date period of interest grabs the latest image. Depending on the API services used, the process may only have access to slightly older data due to
5 cloud filtering.

The output from this process is image files (advantageously in GeoTIFF format).

b) Cloud Processing

10 The obtained images are cloud filtered as standard, or come with an overlay that describes where clouds have been detected in the images. Some filters (such as UV images) work through clouds but still experience some distortion. This allows the process to stitch images together to get a more up-to-date image than the previous step. The system is preferably able to extract
15 elements from newer images that are cloud free and 'stitch' those into older images to get a more up to date image for an area. The output of this step is the same as the previous step, but the images may be more recent in parts.

c) Shadows

20 All images which are acquire can be expected to have ground shadows (not cloud shadows). The process performs two routines - the first to calculate where the shadows are (which can be done with a variety of existing algorithms) and remove them, but also by using the time of day and geo-location the process can reverse engineer height information from those shadows to help build up a 3D
25 image of the landscape (or at least ascertain building heights).

The output of this step is a shadow-filtered image, alongside some vector information about the shadows which have been removed.

d) Vehicles

30 Once the process has filtered out shadows it investigates the potential for removing vehicles from the roads where appropriate. This will depend on the resolution of the images.

The output is the same GeoTIFF image filtered for vehicles (to a degree).

e) Filters

Finally the system pre-processes the images with a variety of low-level
5 filters to prepare it for later stages.

Street view Data

Street view data provides in the preferred method and apparatus a side or
perspective view of the relief of land and structures in a zone, allowing, for
10 example, review of a particular intersection or feature from the perspective at
ground level to verify if a possible obstruction actually exists. Various method
steps may be to determine if there is an obstruction visible on the image.

Buildings

15 Buildings can be identified, in the preferred embodiments by the following
routines.

a) Filters

The first step in processing buildings is to apply filters to remove areas of
20 no interest. This includes filtering out green areas via a colour filter and then
running a blurring filter to remove small details (only medium-scale detail is of
interest). The process also alpha-masks the entire road network out of the image
so that it can be ignored in this processing.

b) Edges

25 Preferably, a Sobel edge detection routine is then run on the image, which
provides a greyscale output image that shows where all the edges are detected.
This will outline all the buildings and other small features that are left outside the
road network. This also removes all extraneous detail from the image and the
30 output is a grey scale image showing feature outlines.

c) Small Features

The output of the edge detection routine is then put through a second filter to remove small details - this should remove anything else that is small (e.g. sheds, cars that have not been filtered out, small geographical features).

- 5 These preliminary filters should provide an image which is almost entirely buildings and small feature based.

d) Transforms

- 10 The preferred process is only interested at this stage in the zones, or blobs, that are left, which are all a certain size or above. For each zone the preferred routine simply stores the approximate centroid of that zone and its size. It is not concerned with vertices or anything else - buildings will either grow in size (which means the size of the zone or the centroid will change significantly (i.e. more than 10%), or appear (i.e. a new zone exists).

- 15 The comparisons run here will check the number of zones in a region (which should stay constant if there is no change) and the approximate location and size of each zone (small changes are ignored, again we are using fuzzy logic to determine them).

20 'Normalised' Map data

- Normalised data is produced by the preferred method and system by intermixing LIDAR data together at a single resolution and overlaying that with boundary and land use data. This combination of zone data provides an optimum model for determining ground surface water flow, which may for example use a
25 'rolling ball' model to describe such paths and pooling of water.

Sewer Layers Data

- Sewers layer data may be determined from water companies and describes the underground model including relevant flow metrics. This is used in the
30 preferred method and system to calculate the capacity of the sewer network and to check for any backflows and so on.

Paths and Pools model

The paths and pools model used in the preferred embodiment describes how water flows on the ground according to land topography, land types and any barriers found from satellite imagery/street view.

5

Final pluvial risk analysis

Once combined map data for a zone has been generated and flood risk determined, the method and system of the preferred embodiment provide a green/amber/red matrix showing the probability of flooding in each area within that map.

10

Error ratio

In the preferred embodiment, calculated through each step above is an error coefficient. Each step determines how much error gets added in (as a 2D value across the map). This is also reflected in the pluvial risk calculation at the end (so an area could be red with a small error ratio, which indicates a higher risk potential).

15

Use of Process in the Detection of Leaks

In addition to being useful in the prediction of flooding, the system and method taught herein can also be used for other application. One is in identifying leaks in pipework, for instance.

20

To look at water leaks in pipelines the preferred system makes two assumptions. First, leaking water in a pipe will cause a natural cooling in the ground area around that leak. Secondly, that cooling is detectable by a thermal satellite image.

25

a) Source data

The routine uses two sources of data - the pipe network (expressed as vectors) and a thermal satellite image.

30

The two sets of data are overlaid over one another and then each pipe link is followed along its route and store a thermal gradient for each unit of distance of

the pipe in the database. This gives us a baseline for that pipe to see how it might change in the future. The thermal gradient for a pipe should be fairly constant; subject to ground conditions (different types of ground cover would have different thermal properties).

- 5 For each pipe vector a sequence of numbers is stored for each unit of measurement of the image obtained (depending on the satellite data resolution).

b) Update data

- 10 Then, on a periodic basis, the system would run the same algorithm again giving a new thermal gradient for that pipe length. Comparing that to the original pipe gradient can highlight where there was a peak or trough different from the original pipe. If the overall gradient was the same for that pipe (irrespective of being slightly warmer or cooler due to transient conditions) then it can be ignored. This is done by normalising the data across the two readings (taking the average
15 of each and subtracting the difference from the higher reading to bring the two charts into line). If there is then significant deviation this is flagged up for review.

Use of Process in the Detection of Vegetation encroachment
on power lines/railways

- 20 In a similar vein to the pipeline network above it is also possible to look at near-infrared and green imagery. Again we the system and method follow the network of vectors for the underlying network, only this time extrapolating out each side perpendicularly for a pre-set distance and storing those numbers as well. The routine is in effect looking for significant change in either the green spectrum or
25 certain parts of the near-infrared spectrum that indicate significant changes in vegetation.

This will also be tied into a growth model suitable for the type of vegetation in that area (determined from geographic location) and rainfall/weather estimates to ensure that future prediction is dealt with as well.

- 30 The process preferably includes the following routines.

a) Initial image

Using standard satellite imagery and near-infrared imagery, overlay the associated network as vectors.

Following each vector along its path way, calculate the broad path by
5 extending out perpendicularly for a pre-set distance each way.

Store the green colour details (hue and saturation) and near-infrared details for each pixel.

b) Subsequent Images

10 Use the same subroutine as above and compare the relative data.
Highlight significant changes in colouration (hue or saturation) and points where new pixels are encroaching onto the underlying network (that is getting closer to the vector in question).

c) Growth Models

15 The preferred embodiment also runs a growth model simulation on that section of track to see the likely changes based on forecast rainfall/weather for the region and the usual vegetation type. This is an estimated calculation to see if there is likely to be significant growth over the next 3 to 6 months.

20

ProcessesTopographical Generation

25 This phase or the method or element of the apparatus combines the data sets from LIDAR data at various resolutions with land registry data and Ordnance Survey data to determine an accurate topography of the ground in a zone under consideration. This works in the following steps:

1. Use of linear interpolation and extrapolation to intersect LIDAR data sets if they are at different resolutions, adjusting error ratio across the map accordingly
30 (upwards in the case of worse granularity of data). This provides a single granularity of data (at the highest resolution available, which may be interpolated for some areas at a higher error ratio).

2. Overlay of this data with building information and land use information from the OS maps to allocate each LIDAR data point with a 'land use' type to assist with the rolling ball model.

a. Optionally, incorporating satellite imagery at this point to further enhance this data with more accurate information from the ground. This could be done by using colour filters (such as dropping out blues) and tuning the contrast of the image to produce more accurate land use descriptors (the method and system may pick up different tones of colour and potentially patterns to determine the type of ground, for instance grass, overgrown areas, rural land, concrete and asphalt which all have different run off characteristics for water flow).

3. Examining any bridges and tunnels on the OS map and adjusting the relevant LIDAR data points to the lower values (that is, within the bridge/tunnel) to ensure accuracy and to prevent the creation of a false 'wall' between areas that might be key to creating a flood pathway.

4. Overlay of boundary lines from Land Use data to determine where likely boundaries are for boundary crossing checks.

Rolling Ball Hydrological Model

This is an existing, proven system, preferably enhanced and/or adapted to perform better in a multi-use environment and with higher resolution data.

Intersection Checking

Once a pools and pathway model has been determined from the above, the method and system check for any intersection points in each flood pathway with the boundary information from the Normalised map data to see if they are crossing a boundary location. This is done with simple matrix functions.

Intersection Verification

For each boundary intersection identified above, the system and method verifies the corresponding satellite imagery and examines the intersection on that imagery to seek to determine if there is an obstruction on the ground. Again the method and system use image filters (in this example, dropping out different

colours and adjusting tonality of the image) to seek to pick out the line of a wall or building along that intersection, for example. The method and system use the boundary information to determine where to focus, thereby avoiding the need to process the whole image. If the method or system determines there is a wall
5 (preferably with a low error ratio feedback), the method and system update the topographical, combined, image with the existence of a wall (in one example by raising LIDAR data points along the wall where it can be seen) and re-run the hydrological model. This is likely to result in a change to the route of water flow in the area under consideration. The system and method then flag this area to
10 indicate that the area has been adjusted, thereby to avoid a repeat check.

If the method or system determines with confidence that there is no a wall, the method and system moves onto the next intersection point.

If, on the other hand, the method or system is unable to verify the presence of a wall, the method or system checks to see if street-view information for that
15 data point is available from a Street View provider (or angled aerial photography) and a view that section on the ground is determined if available.

The system and method again use image filters to enhance the image to better process the data, in this case seeking to overlay a 2D image into 3D world space to illustrate where the wall would be on the ground in 3D. This is preferably
20 done using simple trigonometric functions and geographical data (map coordinates).

The method and system preferably then examine the area under consideration to see if there is a pattern resembling a wall at the point of interest (preferably using image analysis functionality such as pattern recognition and
25 feature extraction, for instance using Gabor filters to find brick-work like patterns). Again, if the method or system find a clear wall the LIDAR data points are updated to create that wall and the rolling ball model is rerun. Uncertainty in this case is illustrated by extending the error value "down the pathway from the wall" as well as in the locality of the wall.

30 If street view data is not available the method and system preferably raise the error value in the area concerned, and extend that error ratio outwards around the area concerned based on how likely the wall is to exist.

1d-1d Hydrological model

This creates a pluvial risk factor at each point based on the intersection of water flow from the paths and pools model created by the Rolling Ball model
 5 (adjusted for obstructions) and the sewer network. This creates a close-to-realistic model of how actual rainfall is likely to progress through the sewer system, based on high capacity rainfall over an extended period (data supplied in this case by the Meteorological Office). Each LIDAR data point may be given a flood risk indicator from 1 to 100 and this is then translated into Red/Amber/Green status based on
 10 pre-determined rules.

Error calculation

An error calculation is an overlaid value across the LIDAR data points in the map. Each LIDAR node has a start error value of zero which increased by each
 15 level of uncertainty about that node (for instance from interpolated LIDAR data, uncertainty around path flow data and perhaps uncertainty around land use).

Curb Identification

Curbs can be identified by the following algorithm:

- 20 1. Overlay byway information onto satellite imagery (byway is freely available from OS on their vector product map)
2. Run edge analysis on the satellite imagery to enhance edges
3. Follow roads lines (with deviations and error margin) to find boundary edges. Extrapolate curbs alongside roads to factor around bridges, trees and any
 25 vertical obstructions. Use ground colouration on original map data to determine which are curbs (they have a fairly distinct and uniform colour as a rule).
4. Describe curbs using shape information from the above and store as an overlay for LIDAR DTM
5. To check joe guts of curbs use street view and compare against
 30 street furniture, cars, car tyres in places along the street.
6. To see where curbs dip into the road look for colour changes in photo and/or shading at intersections and driveways.

Tracking Changes in Zone Data and Maps

The following is a preferred embodiment of process for tracking changes in satellite imagery over time.

- 5 The preferred embodiment does not store original satellite imagery (which may require very large storage commitment). The preferred system, by contrast, stores a series of hashes for satellite imagery (both computational hashes using standard algorithms such as MD5 and image processing hashes such as Gabor filters that describe the detail of the image in numerical terms) and lower resolution
- 10 black and white imagery representative of the edge enhanced version (which has much lower storage requirements than a full colour image). Those hashes are computed from two areas:

- Both involve losing the fine-grain detail between images but provide an effective overview of the diagrammatic representation. This means the system
- 15 would pick up large scale change but not the small details that would change (e.g. cars moving, seasonal changes). The system may still pick up some false negatives (for instance a large car park will provide a totally different image between two satellite images), but it is better to have false negatives than false positives (that is where a change has occurred but is not detected).

- 20 From an algorithmic perspective the preferred embodiment performs the following:

1. For each map square (for instance, 1km² resolution square):
 - a. Scale the satellite imagery to a standard resolution (to ensure scaling does not adjust the representation)
 - 25 b. Calculate Gabor values and MD5 values for the satellite imagery
 - c. Create an edge enhanced version using Sobel edge enhancement and refine to 16 colour b&w at a low resolution (this produces a 'maze' like representation of the image that outlines key features but loses detail)
 - d. Store both aspects in a database and link the edge imagery
- 30 2. When new map data becomes available, carry out steps a, b and c and compare to the original as follows:

- a. MD5 hash will determine if there is the exact same image or not instantly without any further refinement
- b. Gabor filters will determine if there is no underlying change to the image on a visual basis, but the image is different (that is, it is another image taken by a different aircraft/satellite but nothing has really changed)
- c. Edge enhanced version will then allow to verify which areas have changed (the system may also shift the edge enhanced version around to marry up with the original image in case the imagery is out of sync with GIS references slightly) if any.

Data Processing

The flow chart of Figure 1 shows the data processing steps of the preferred method. As will be apparent to the skilled person, the method shown provides an iterative data formation process for producing the combined data map and therefrom the determination of flood risk within the zone. The combined data map provides a much more complete indication of the topography within the zone in question, much better able to predict with better accuracy possible flood risk within the zone.

The plurality of data sources enables the method and system to identify elements which are not shown in cartographic maps. For instance, not only may walls not appear on a cartographic map but even if they are depicted, other separation structures, such as fences and the like, interact with water differently than a wall. The same applies for a hedge. The use of a plurality of data sources and in particular image data enables the method and system to distinguish between the various types of structures, and specifically can provide clarity as to how water passes along or through such structures.

The use of 3D views can identify alleyways, by using analogous methods as those for identifying walls. Hedges and trees can be identified by colour filters on satellite views and using boundary information as a starting point for assumption of the existence of possible hedges and trees. Walls and fences are identified by colour filters on satellite views and using boundary information as well.

The type of structure can be identified by 3D views overlaid with 2D images to give GIS DATA. The overlaid data views can then be converted to greyscale and the contrast increased, which provides a platform to use pattern recognition to identify the type of structure being analysed.

5 The preferred method and system advantageously learns. For example, each week/biweekly the system may review old satellite imagery and compare it to more recent to identify any changes to structures, road layouts and topographies. The system may use planning applications and road highways data to know when changes might occur and when to look at areas more frequently.

10 Figure 2 shows in very schematic form the basic components of a system for implementing the methodologies taught herein. The system includes in this embodiment a central processing system 100, although in other embodiments there could be a multiplicity of individual systems, for example used at customer or utility locations. The system 100 includes a data collection and processing system
15 or unit 102 which receives data from a plurality of external data sources 100a-100n of any of the types disclosed herein, and possibly also from a database 108, which may be internal to the system 100. The data sources 110 may provide stored or real time data while the database 108 may store more long term data, an example being OS map data.

20 The system 100 also includes a predictive engine 104 which generates one or more predictions, in the preferred example of flood risk in an area being surveyed. There is also provided an output unit 106, which may provide one or more warning indicators, such as a "traffic light" warning system as described above, acoustic and/or visual indicators, as well as communication to third parties
25 by any suitable telecommunications system including telephony, via the internet, via a cellular or satellite network and so on. Some examples are set out elsewhere in this specification.

 Some specific examples of data processing carried out by the system and method taught herein are now described. The examples are optimised for
30 determining pluvial hazards, by enhanced DTM, changes in DTM, including pathways and ponds; for capacity prediction, that is water supply/usage prediction; and also for identifying network anomalies, such as pipework leaks and metering

anomalies, in which water usage can be identified and compared to associated metering records. The preferred system creates an enhanced DTM that automatically identifies detailed features in the real topographical environment. It can automatically identify curbs, hedges, fences, walls and bridges, for example,
5 and create a map of urban features within an existing DTM. This can be achieved with no costly human intervention, no human error, and is able to provide very accurate mapping from existing, low resolution DTMs.

The preferred system includes an Image Differential Engine which identifies changes over time in a given environment using automatic comparative analytics.
10 This automatically compares historical and contemporary records, identifies where changes occur, can send alerts for updates. As only selective updates of the DTM are required, the system is very cost-effective in terms of processing requirements. Referring to Figure 3, this shows in schematic form an example of a map having superimposed an indication of fluvial hazard, achieved by accurately modelling
15 pathways and ponding of pluvial surface water and its interaction with storm drain and sewer networks.

Figure 4 shows a map overview for building an enhanced DTM. Preferably, raw LiDAR data is converted to a raster and then used 'as is'. Features such as bridges (figure 4) form anomalies that may skew flow path calculations. Highway
20 curbs not shown in normal DTMs can greatly influence flow paths. The enhanced DTM automatically picks these and other features out so they can be corrected to form a highly accurate model of the topographic environment.

Tarmac Detection

25 Figure 5 is a satellite image used for identifying areas of tarmac in a zone. Satellite images are used and colour filters and hue/saturation filters then applied. Shadows affect tarmac images very strongly so are pre-processed to create an approximate alpha-mask for tarmac / asphalt. With reference to Figure 6, this shows the preferred alpha mask output, in which combined street centre-lines
30 creates a solid road network. There is a low error coefficient due to combined data.

Bridge Detection

Bridges and other overhead structures can be detected as follows. Figure 7 is a satellite of a zone with a bridge. Main water flow paths are often along roads. Bridges present a solid obstacle on LiDAR data as it is only a 2D raster image.

5 The preferred method and system processes out bridges automatically using tarmac identification. That is, the street algorithm overlays tarmac to find bridges. Figure 8 shows the LIDAR data prior to processing. This is compared to a street centre line database (of main thoroughfares) and satellite data (for tarmac detection/anomaly detection). With reference also to Figures 9 and 10, short
10 sections of streets are processed at a time. Street width is determined from boundary data or tarmac detection and also average height across the street width is calculated. If there is a distinct spike in street height this is deemed to be a bridge, or other overhanging structure. Average street height is calculated using linear regression and overlaid on bridge sections.

15 Referring to Figures 11 to 13, these show an example of processing of map data and street view data to identify a bridge. Figure 11 shows a map with a possible bridge highlighted from the map lines. A street view image (Figure 12) is obtained from one of the known sources, of the structure identified in the map. For this routine, all other objects apart from the bridge are ignored for the purposes of
20 processing. Linear regression (Figure 13) is used to align bridge height to street level. Seen right, elevated features now correspond to street level and will not falsely influence indicated flow pathways.

Hedge Detection

25 With reference now to Figures 14 to 16, these show the processing of image data to identify hedges and fences. Fences and hedges obstruct (and to a degree absorb) water flow. Fences are often too thin to be detected on LiDAR data. The method and system find fences and hedges along property boundaries and check for their presence on LiDAR data, which produces more accurate flow
30 paths for water. With reference to Figure 15, this shows LiDAR data (for verification information), property boundary data (APN parcels) and satellite data (greenery detection / edges). With reference to Figure 6, filters are applied to the

satellite image to pre-process the data as follows: colour detection is used for hedges, edge detection is used for fences. Boundary lines are overlaid and checked for presence of a fence/hedge. Colour detection confirms the type. Finally, a cross-reference is preferably made to LiDAR data for relevant elevation changes.

Tree and Grass Detection

Referring now to Figures 17 to 19, these show how grass and trees may be detected. Grass and tree lined areas affect water absorption and flow rate differently to asphalt / concrete. Areas of grassland are not always accurately mapped. Individual trees can be detected if isolated, otherwise areas of trees can be isolated from grassland. Referring to Figure 18, LiDAR data is obtained, as is satellite data (multiband). Hue/saturation/luminance filters may be used to highlight the elements of interest. With reference to Figure 19, filters are applied to satellite image to pre-process the data. For instance, colour detection is used for green areas, texture analysis/comparison is used for differentiation between grass and tree, blob analysis is used for individual tree isolation (where possible). This data is cross-referenced to LiDAR data for tree verification (height information).

Curb Detection

Figures 20 to 24 depict the identification of curbs in a zone of interest. Curbs do not show up on LiDAR data, although they can significantly affect flow of flood water. Curbs have less impact when floodwater rises. With reference to Figure 21, street centreline data is obtained as well as LiDAR data (to adjust heights - also output), satellite data (road width / asphalt x - 60cm) and a street view (curb height z-20cm). With reference to Figure 22, filters are applied to a satellite image to pre-process the following parameters: colour detection/radar for asphalt areas. The street centre line is then overlaid, for the determined road widths. This can be cross-referenced to a street view for curb height processing. There is lower LiDAR data in the mid-street section, to produce better street profile. On a digitised map (Figure 23), a numerical list of identified and measured

roadside curbs can be produced for later efficient data harvesting. This can also be stored in a database, as depicted in Figure 24.

Wall Detection

5 Figures 25 to 29 show how walls can be identified and also some issues with buildings. With reference first to Figure 25, small boundary walls do not always get picked up in LiDAR data, yet they can have a significant impact on both flow pathways and rising floodwater (constraining or directly flow thereof). Walls are more likely to change rapidly on local landscape. The method/system cross-
10 reference various data sources to produce estimates of walls and adjusts LiDAR data accordingly. With reference to Figure 26, the following data is utilised: LiDAR data (to verify / adjust data), satellite data (for edge detection) and boundary information (APN Parcels) - best place to search. Referring now to Figure 27, filters are applied to the satellite image to pre-process as follows: an edge
15 detection routine (e.g. Sobel) is used to find edges; boundary information is overlaid onto the processed image to find matching lines; a cross-reference to colour profile to original satellite image is used to find best match and eliminate false positives; a cross-reference is made LiDAR data to find if already contained in data (or false positive, e.g. building edge), if not adjusted appropriately.

20 Figure 28 depicts some data issues which may arise from such processing. There may be too many extraneous plots in the data and roads may be included in plots, creating false positives. Figure 29 shows further issues. Buildings are highlighted as 'plots', some of which may be overlapping. Plot data for land parcels may be too inaccurate, included building outlines in some cases and
25 random sections of roadway in other places. Wall detection is usually more suitable for residential areas rather than commercial areas.

Building Detection

30 With reference now to Figures 30 to 35, these show how buildings may be identified. Referring first to Figure 30, buildings are often highlighted in LiDAR and other data, though they change over time (development and demolition). Building roof structure contributes to ponding, so more accurate building maps can provide

more accurate flow models and ponding. Building data can be used to improve LiDAR quality. With reference to Figure 31, the following data may be used: satellite Imagery (2D multi band); vector information from Open Maps and the Government, and LiDAR Data. Referring to Figures 32 to 35, the system employs
 5 colour filtering, roof-line ridge detection (illustrated), comparisons with LiDAR Data, as well as feature extraction from other data sources and the generation of an error coefficient from data source comparisons.

Error Coefficients

10 Error coefficients are likely to be very useful in practical implementations of the method and system, for the following reasons: (i) input data is not always accurate, (ii) automated image analysis is not a perfect science, (iii) there is always a chance of false positive and false negative.

For this purpose, each data artefact that is calculated comes with an error
 15 score. Finding the same data artefact in multiple sources increases the error score (higher = more valid). Only high value artefacts are used in final calculations. For example, for bridges the presence on LIDAR data + presence on map + presence on satellite image is deemed to represent a perfect score. When present on 2/3 it is deemed highly probably, likely to be included for processing. When
 20 present on 1/3, the low error coefficient excluded from processing.

Some artefacts (e.g. buildings, trees and so on) can still have lower scores even though present as detection routines aren't 100% sure. Multiple processes / sources of detection can still increase that score.

25 Calibration of the Data

Urban building characteristics vary from area to area, depending on social, cultural, commercial and demographic considerations.

Referring to figure 36, this shows a demonstration of an area with buildings which are predominantly flat roofed. This creates challenges in writing algorithms
 30 to normalise heights. With reference to Figure 37, seen in contrast, residential buildings in perspective arch-roofed and show up with a greater signature in raw LiDAR data.

A street view system can be used to examine walls from close perspective.

Figure 39 shows building detection, in which tall buildings can be imaged in perspective, which can identify complex shapes, and building layering (multiple tiers), as can very high levels of shadows. Building height can be detected as indicated in Figure 40, by use of historic LiDAR data, OS survey mapping and stereoscopic satellite imagery combined. The height of buildings can be extrapolated from this combined data and this height data used to differentiate between buildings and street level. Satellite stereoscopic data may be approximated DEM with 1-2m resolution. Accurate building layout is overlaid onto satellite data. These measures eliminate errors and increase data quality. They can be used for slums, any building and any area. With reference to Figure 4 1, it can be seen that the processed image has had bridges removed by levelling to street level, roadways dropped where curbs are detected, refined wall and fence structures where these have been discovered. The system and method can add/delete enhancements, create error coefficients and ground truth all features.

The Pluvial Hazard Map

Figure 42 shows an example of a pluvial hazard map. This is generated by 1D/1 D watershed modelling, calculating rainfall, assessing watershed drainage capacities, calculating sewer network capacity and factoring storm drain capacity.

1D/1 D Modelling

Recent developments in flood modelling have led to the concept of coupled (sewer/surface) hydraulic models. Figure 43 shows a 1 Dimensional sewer model coupled with a 1 Dimensional surface flow model (1 D/1 D) and can be used for near 'real time' modelling.

The system and method automate the pathways and ponds modelling, almost instantaneously. They automatically model interactions of surface and sub-surface water. The algorithms within 1D/1 D model make the map very accurate whilst streamlining processed data.

2D Pathway Modelling

With reference to Figure 44, this shows a 2D map depicting possible flood hazards. Ideally, at least three models are created north, south and east of the test area (depending on the topography of the land and direction of possible flood waters). In this example, flow paths for 20, 50, and 100 year flood events are modelled. The modelling preferably shows how surface water interacts with storm drains, sewer networks buildings and roads. This can be used to assess current efficiency of infrastructure, water systems and existing flood mitigation measures and therefore to plan future works to alleviate the issues of flooding in the locality.

Rainfall stations can be used to provide precipitation estimates which can be used in creating a pluvial hazard map. The data typically obtainable from rainfall stations includes station depth, rainfall duration and amount, and frequency curves. A hazard map, as depicted in Figures 45 to 48 can then be generated, with ponds and paths being depicted in blue and ditches being depicted in red. Figures 46 to 48 are zoom views 1 to 3 respectively shown in Figure 45.

Processing - Sobel Edge Detection

With reference to Figure 49, the preferred image processing routine extracts edges from obtained images. The following sub-routines are performed.

Zone creation (from Sobel): takes Sobel edges and produces zones (described by polygons) that approximately match the source image.

Blocking algorithm: turns 'lumpy' LIDAR data into smoother blocks of data, assuming that the data is from an urban landscape (i.e. buildings / streets). Creates smoother building outlines from the LIDAR data.

Zone creation (from LIDAR data): produces polygons from the outlines of suspected buildings within the LIDAR data.

Blurring/processing filters: standard image processing routines that ensure that data is suitable for our feature analysis engine. Varies depending on the source image type but usually consist of Gaussian filters to remove fine-grain pixilation and also shadow smoothing filters to remove source shadows to the highest possible degree.

Feature analysis engine: a core part of the system. Each classification of feature (building, road, tree, water etc. etc.) has a defined set of characteristics stored in a database. These characteristics will vary from region to region, but consist of a set of boundary conditions within each of the source data types.

5 These characteristics preferably consist of the following data types:

Value range (e.g. Red, Green, Blue, Hue, Saturation, Luminance, height range, infrared, ultra violet, radar reflectivity levels and other characteristics)

Calculated characteristics (angled nature of the zone outline, height characteristics of the zone with reference to surrounding area (i.e. step up/step
10 down), uniformity of height across profiled area)

The system the uses a comparison engine which defines each classification of feature by boundary conditions for each of the above characteristics. For each boundary condition that is satisfied by each feature the probability that that feature is of the correct classification. Each boundary condition is weighted as well, with
15 tighter band conditions indicating more likely features.

For instance, areas of water will have a high radar reflectivity, will have higher blue values in the RGB spectrum, will have a fairly smooth uniformity of height and will be flat. These are expressed in terms of boundary conditions.

Boundary conditions will also vary by geographical area. For instance areas
20 of grassland in humid countries will be more green due to better hydrological conditions, whereas they will be more yellow in drier conditions. This is preferably handled in two ways:

Boundary conditions can vary for each feature type across different areas. Even the angle of inbound sunlight can affect boundary conditions, so the
25 geographic area has an impact on the boundary conditions.

Secondly the system 'trains' the boundary conditions by pre-processing a series of training images ourselves and identifying features manually (e.g. areas of water, buildings, road networks, grassland and trees). The system then uses an artificial intelligence engine to create boundary conditions for the peak areas for
30 each of those images.

Fundamentally the 'feature space' is a multidimensional cube (hypercube) with discrete zones within that space representing each type of feature the system

seeks to select. The AI routine scans across each of those features and creates a bounding space for each type of feature that identifies 95%+ of the matching pixels (for images) or the closest range of features for non-pixel features. The AI routine will also zone in on tighter bands where there is a higher match percentage
5 (so we handle wide-spectrum fits more intuitively).

For instance, looking at the following feature graphs showing some examples of the boundary conditions.

Figure 50 is an example of feature band matching in the RGB space. The vertical line indicates the median point of the colour space and the broad band
10 underneath the graph indicates the width of the 95% band. As can be seen from these samples, this creates a nice clear colour space (this example is for back garden pools).

However looking at a feature profile for pools in a different area, that is Figure 51, a very broad spread of colour data can be seen. However, looking at
15 the same data within hue/saturation and luminescence as per Figure 52 one can see nice narrow bands of feature recognition. Thus, in some circumstances the RGB spectrum is of no use, however from Hue/Saturation/Luminescence we see a very different picture emerges. Some features have dramatically different profiles across the many different criteria used to differentiate, and the system/algorithm
20 has the capacity to identify different features from different satellite spectrographs or be extended into other remote sensing features (for instance one calibration mechanic is the height variance of LIDAR data across the profiled area).

The data objects are preferably broken down into the following:

Zones: Areas of interest within the map section being looked at (created by
25 the zoning algorithm).

Feature types: Different types of features sought to be extracted (e.g. buildings, trees, areas of grass).

Criteria: The individual elements of data looked at to determine which feature is which (e.g. red colour value, radar reflectivity, LIDAR height variance).
30 These are all expressed as numerical values within a defined range.

Boundary condition: The numerical 'spread' of each criteria linked to a feature type.

Percentage match: The probability that each zone corresponds to one feature type.

Error coefficient: An indicator of our confidence that each zone corresponds to one and only one feature type.

5 The preferred matching algorithm follows the following rough pseudo-code approach:

```

10       For each identified zone
           Calculate all criteria
           Set percentage match to zero
           For each feature type
               If the zone features are within the boundary condition of that feature type
                   Increment the percentage match by the feature type percentage
15           End If
           Next Feature Type
           If one (and only one) feature type is above our threshold level for identification, mark it as
           that type
           If no feature type is above our threshold, and one is significantly higher, mark it as that
20       type with a small error coefficient
           If more than one feature type is above our threshold, take the highest value match and
           mark with a small error coefficient (based on the difference between the matched type and the
           next closest match)
           If multiple feature types all have low match values then take the highest match and store
25       with a high error coefficient based on the difference
           Next zone

```

The preferred artificial intelligence engine works on the following pseudo code algorithm:

30

	<i>For each feature type</i>
	<i>For each identified zone</i>
	<i>For each criteria</i>
	<i>Calculate the spread of criteria</i>
5	<i>Calculate the median of the criteria values</i>
	<i>Examine the spread of the criteria -</i>
	<i>If a narrow band calculate the boundary that represents 95% of the criteria</i>
	<i>If a broad band calculate the boundary that represents a smaller percentage but a</i>
	<i>significant portion of the criteria.</i>
10	<i>Based on the number of criteria, assign an arbitrary percentage value to the</i>
	<i>boundary condition (based on the number of criteria and band spread)</i>
	<i>Next criteria</i>
	<i>Examining the boundary conditions again, adjust the percentage of each narrower band</i>
	<i>up and each broader band down to create the best possible match.</i>
15	<i>Next zone</i>
	<i>Next feature</i>
	<i>For each feature type</i>
	<i>Examine boundary conditions for other zones and see if there is dramatic overlap</i>
	<i>If there is, examine tightest bands for those zone types (that are different) and adjust</i>
20	<i>percentage values accordingly (upwards) and other percentage values downwards</i>
	<i>Next feature type</i>

These features sets can also be created manually for some parameters, for example:

	Building	Water	Grassland	Road
Colour Spectrum	Varied (5%)	Blues (20%)	Greens (20%)	Greys (20%)
Radar Reflectivity	Varied (5%)	High (20%)	Varied (5%)	Low (20%)
Height variance	Fairly uniform (i.e. low) - 20%	Uniform (20%)	Varied (5%)	Uniform (20%)
Height comparison	Higher than surrounding -	As surrounding/lower	As surrounding (20%)	Lower/same (20%)

	20%	(10%)		
Zone outline	Regular (straight lines) - 20%	Varied (5%)	Varied (5%)	Straight lines (20%)

These are just some samples of data types that can be used. The system/algorithm is extensible to accommodate various types of raster and vector data. For instance, proximity to boundary lines can be a criterion for detection of walls.

In cases where no LIDAR is available, DSM can be created from two satellite images, for instance at 1m z resolution, which can provide a rough height of features.

The teachings herein can be used for a variety of other applications, a few of which are described below.

Power line and rail network vegetation encroachment

The system and methods taught herein can also be used to identify and/or predict encroachment onto power lines, the rail network and so on of vegetation, enabling authorities to take action before the occurrence of any problems by such encroachment.

A preferred embodiment of this routine includes the following features:

- 1) Satellite imagery in visible light, UV and IR spectra is collected for the area of interest on a given date;
- 2) Using filtration, a signature curve is generated across the plane of the power cable or rail line at 90°, extending into the tree/vegetation line either side;
- 3) The data in this curve will have unique characteristics formed by the difference in shading from the presence of a variety of vegetation. Dense tree formations, lighter tree formations and scrub/grassland for example will all produce distinct signatures, hence identifying vegetation type/density boundaries in the area;
- 4) This initial curve is used as a calibration reference for subsequent curves derived from future imagery;

5) Further satellite imagery as above is sampled at regular intervals. The curves generated from this new data are compared to the original reference curve to determine where change has occurred in the vegetation signature;

6) The comparative process is completely automated, relying on relatively
5 low resolution imagery to simply determine differences between sets of data, sampled over time;

7) Therefore the difference derived from comparing historical and contemporary data curves shows where the vegetation profile has changed in the given area.

10

Water pipe leak detection

A preferred embodiment of this routine includes the following features:

1) Satellite imagery in visible light, UV and IR spectra is collected for the area of interest on a given date;

2) Extending into the soil either side of the pipe, a signature curve is
15 created by determining the characteristics of the soil surrounding the pipe;

3) The data in this curve will have unique characteristics formed by the presence or lack thereof of moisture at the time of image sampling;

4) This initial curve is used as a calibration reference for subsequent curves
20 derived from future imagery;

5) Further satellite imagery as above is sampled at regular intervals. The curves generated from this new data are compared to the original reference curve to determine where change has occurred in saturation levels in soil surrounding the pipe;

6) The comparative process is completely automated, relying on relatively
25 low resolution imagery to simply determine differences between sets of data, sampled over time;

7) Therefore the difference derived from comparing historical and contemporary data curves shows where the saturation level has changed in the
30 given area, and thus determines where a failure in the pipe has occurred.

Rail embankment/escarpment landslip detection

A preferred embodiment of this routine includes the following features:

- 1) Satellite imagery in visible light, UV and IR spectra is collected for the area of interest on a given date;
- 5 2) Extending into the embankment or escarpment either side of the rail line, a signature curve is created by determining the characteristics of the soil surrounding the line;
- 3) The data in this curve will have unique characteristics formed by the presence or lack thereof of moisture at the time of image sampling;
- 10 4) This initial curve is used as a calibration reference for subsequent curves derived from future imagery;
- 5) Further satellite imagery as above is sampled at regular intervals. The curves generated from this new data are compared to the original reference curve to determine where change has occurred in saturation levels in the embankment
- 15 or escarpment;
- 6) The comparative process is completely automated, relying on relatively low resolution imagery to simply determine differences between sets of data, sampled over time;
- 7) Therefore the difference derived from comparing historical and
- 20 contemporary data curves shows where the saturation level has changed in the given area, and thus determines where the potential for landslip is present.

The method and system disclosed herein can be used in a variety of applications, including for instance:

- 25 Changes to flood maps over time. So the processing could be run once then again at 6 months intervals, which will show if there are any changes in the system;

Revenue assurance for utility companies

- 30 Planning applications and tax for governments, illegal planning, tree/grass maintenance, illegal cutting of trees, council tax, fluvial/coastal/groundwater flooding, creation of maps, insurance industry real understanding, disaster relief, disaster mapping, mapping of slums, mapping of battlefields/tanks, making of

satellite navigation systems, making of robot intelligence, driverless cars, driverless drones, sea mapping, plane crash/boat sinking mapping, mapping in smoke or mapping on other planets.

3D Glasses - for visualising flood risk, underground systems particularly
5 drainage and sewerage networks;

Construction workers and surveyors - for predicting possible flood risks, redesigning proposed systems and/or or making changes to structures in order to redirect flood water;

Other models of flooding

10 Other models for insurance and mortgages - for instance for assessing flood risks in dwellings and other buildings and in suggesting remedies;

Oil exploration

Vehicle navigations and control systems

Robots - for guidance systems

15 Changes to how companies create maps

Drones - for guidance systems

Navigation

In addition to the features and functionalities disclosed above, the combination of data from different sources makes it easier to identify changes
20 within the zone and as a result to focus reprocessing effort, which can reduce significantly the overall processing volume thereby to make the method able to be scaled up to cover very large zones. The combined data map can be updated by using data from planning applications, information on byways, changes to satellite or aerial images over time and so on.

25 Other data inputs include: higher resolution images, drones, planes, 8 band images, multiscopic images, sonar, IR, L band radar, other bands of radar, microwaves, and so on.

The system can also be used to superimpose on existing data maps proposed works, such as planned roads, buildings, walls, water drainage systems
30 and so on, to determine the likely change to flooding risk and therefore whether those planned changes are viable.

All optional and preferred features and modifications of the described embodiments and dependent claims are usable in all aspects of the invention taught herein. Furthermore, the individual features of the dependent claims, as well as all optional and preferred features and modifications of the described
5 embodiments are combinable and interchangeable with one another.

The disclosures in British patent application numbers 15 10006.8, 15 16403.1 and 1602577.7, from which this application claims priority, and in the abstract accompanying this application are incorporated herein by reference.

CLAIMS

1. A method of determining risk of an environmental event in a zone caused by an environmental element, including the steps of:

5 obtaining zone data from a plurality of sources including at least one cartographical map and at least one plan view image of the zone;

superimposing the data from the plurality of sources to form a combined data map;

10 determining from the combined data map the nature and location of obstacles to the environmental element;

determining from the determined obstacles a likely path of movement of the environmental element in the zone; and

determining from the determined path one or more areas in the zone at risk of an environmental event.

15

2. A method according to claim 1, including the step of obtaining an aerial image as the plan view image.

3. A method according to claim 2, wherein the aerial image is a visual
20 image of the zone.

4. A method according to any preceding claim, including the step of obtaining a perspective or elevational image of at least a part of the zone, the combined map data including said perspective or elevational image.

25

5. A method according to any preceding claim, wherein the plan view image is obtained from LIDAR data.

6. A method according to any preceding claim, wherein the
30 cartographical map is an Ordinance Survey map.

7. A method according to any preceding claim, including the step of obtaining land registry data, the combined data map including said land registry data.

5 8. A method according to any preceding claim, including the step of obtaining street sewer location data, the combined data map including said sewer location data.

9. A method according to any preceding claim, including the step of
10 determining topographical data of the zone, the combined data map including said topographical data.

10. A method according to any preceding claim, including the step of obtaining land slope data, the combined data map including said land slope data.
15

11. A method according to any preceding claim, including the step of generating a warning indicator relating to the determined risk of flooding.

12. A method according to claim 11, wherein said warning indicator
20 provides a visual environmental event risk indicator.

13. A method according to claim 12, wherein said risk indicator is a coloured indicator.

25 14. A method according to claim 13, wherein said coloured indicator includes a plurality of different colours, each indicative of a level of determined risk.

15. A method according to claim 14, wherein said different colours
30 include a red indication for a determined high risk of the environmental event, green for a determined low risk and amber for a determined intermediate risk.

16. A method according to any preceding claim, wherein said environmental event is flooding and the method detect for surface water.

17. A system for determining risk of an environmental event in a zone
5 caused by an environmental element, including:
an input unit configured to obtain zone data from a plurality of sources including at least one cartographical map and at least one plan view image of the zone;
a processing unit for superimposing the data from the plurality of sources to
10 form a combined data map, for determining from the combined data map the nature and location of obstacles to the environmental element, for determining from the determined obstacles a likely path of movement of the environmental element in the zone, and for determining from the determined path one or more areas in the zone at risk of an environmental event.

15

18. A system according to claim 17, including an input configured to obtain an aerial image as the plan view image.

19. A system according to claim 18, wherein the aerial image is a visual
20 image of the zone.

20. A system according to any one of claims 17 to 19, including an input configured to obtain a perspective or elevational image of at least a part of the zone, the combined map data including said perspective or elevational image.

25

21. A system according to any one of claims 17 to 20, wherein the plan view image is obtained from LIDAR data.

22. A system according to any one of claims 17 to 21, wherein the
30 cartographical map is an Ordnance Survey map.

23. A system according to any one of claims 17 to 22, including an input configured to obtain land registry data, the combined data map including said land registry data.

5 24. A system according to any one of claims 17 to 23, including an input configured to obtain street sewer location data, the combined data map including said sewer location data.

25. A system according to any one of claims 17 to 24, including an input
10 configured to determine topographical data of the zone, the combined data map including said topographical data.

26. A system according to any one of claims 17 to 25, including an input
15 configured to obtain land slope data, the combined data map including said land slope data.

27. A system according to any one of claims 17 to 23, including a warning indicator relating to the determined risk of flooding.

20 28. A system according to claim 27, wherein said warning indicator provides a visual environmental event risk indicator.

29. A system according to claim 28, wherein said risk indicator is a coloured indicator.

25 30. A method according to claim 29, wherein said coloured indicator includes a plurality of different colours, each indicative of a level of determined risk.

30 31. A system according to claim 30, wherein said different colours include a red indication for a determined high risk of the environmental event, green for a determined low risk and amber for a determined intermediate risk.

32. A system according to any one of claims 17 to 31, wherein said environmental event is flooding and the system detects for surface water.

1/29

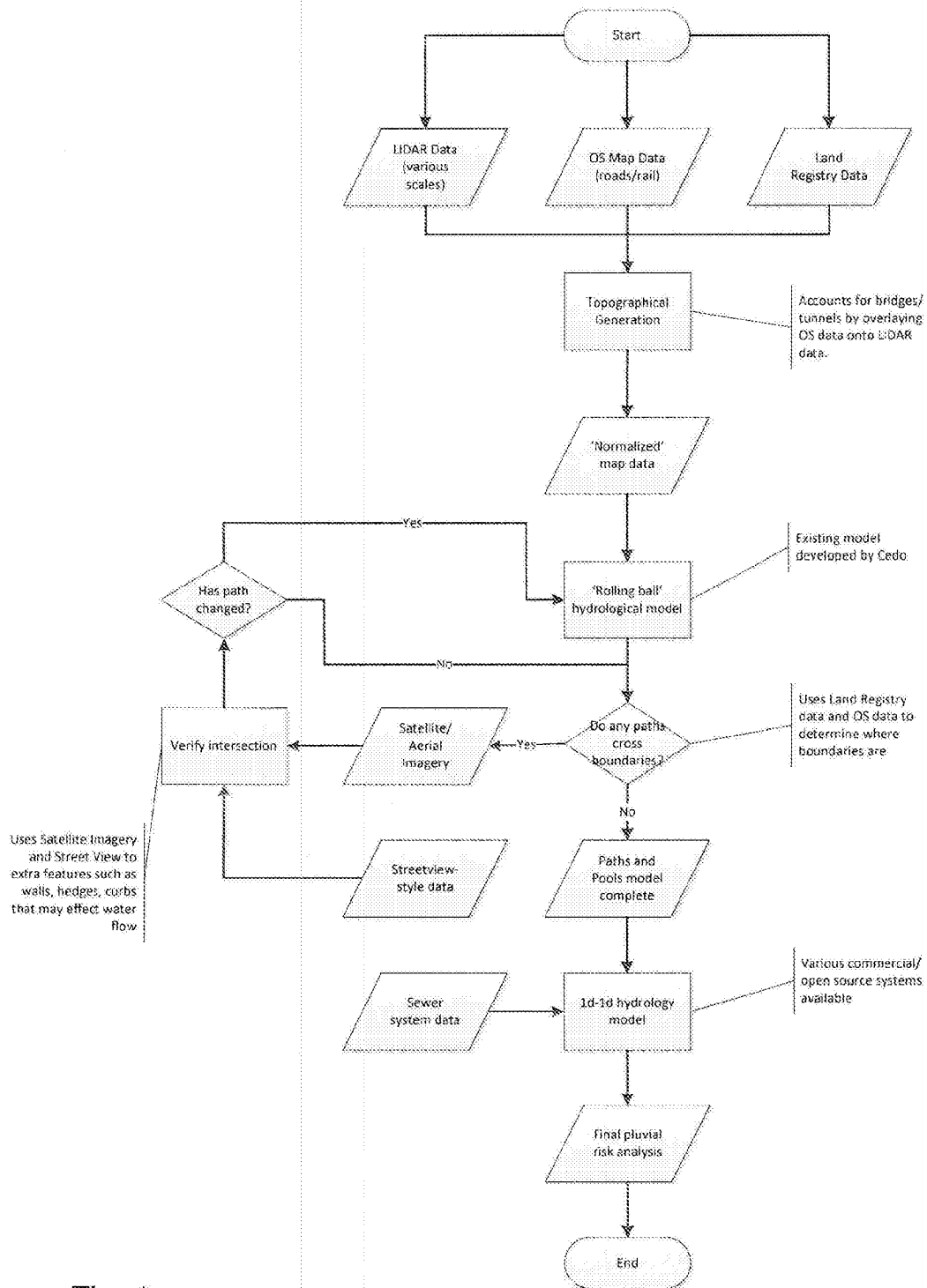


Fig. 1

2/29

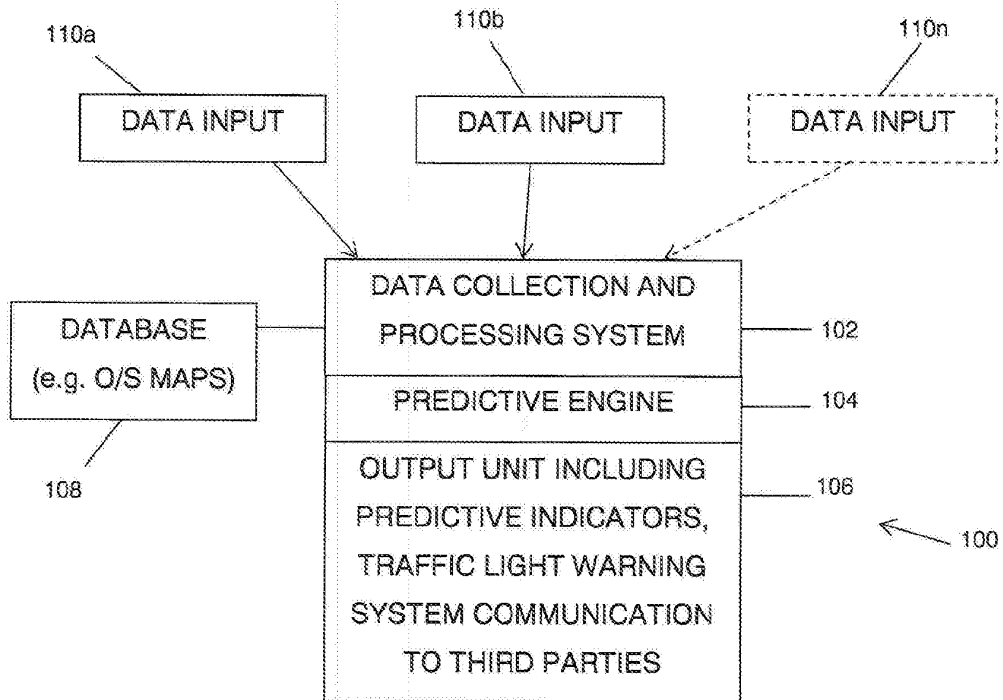


Fig. 2

3/29

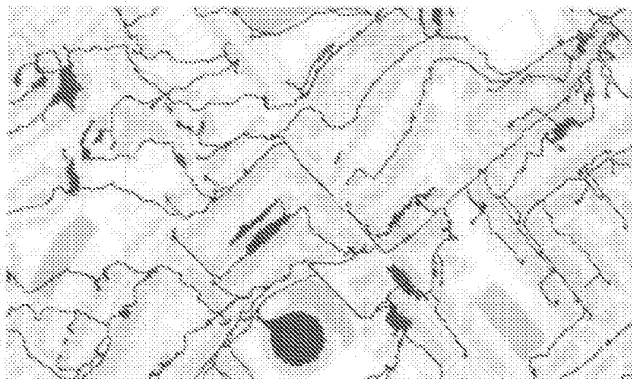


Fig. 3



Fig. 4

4/29

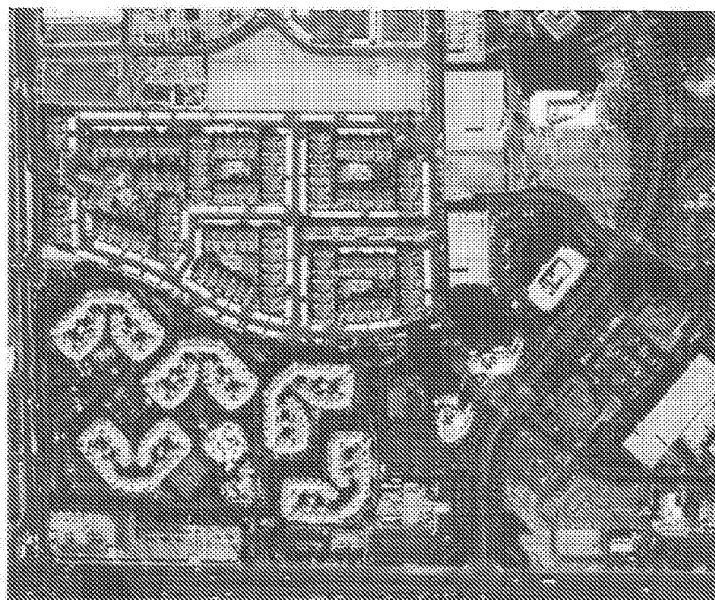


Fig. 5

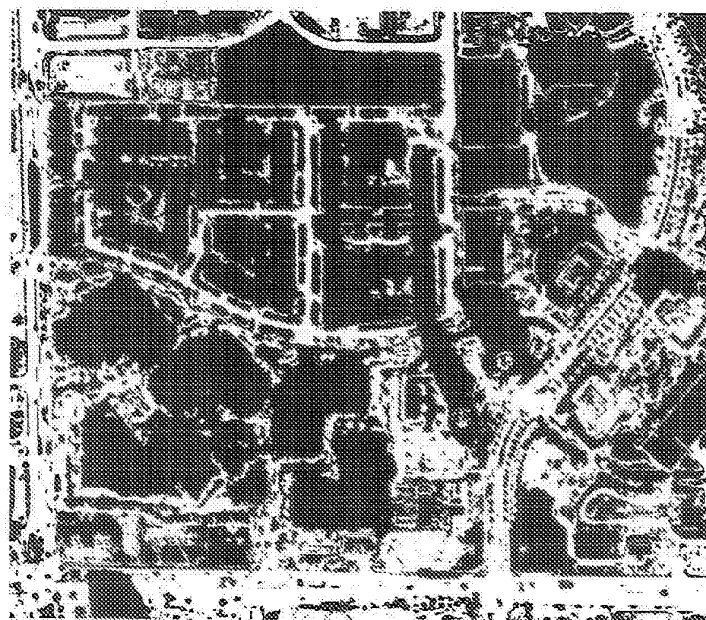


Fig. 6

5/29

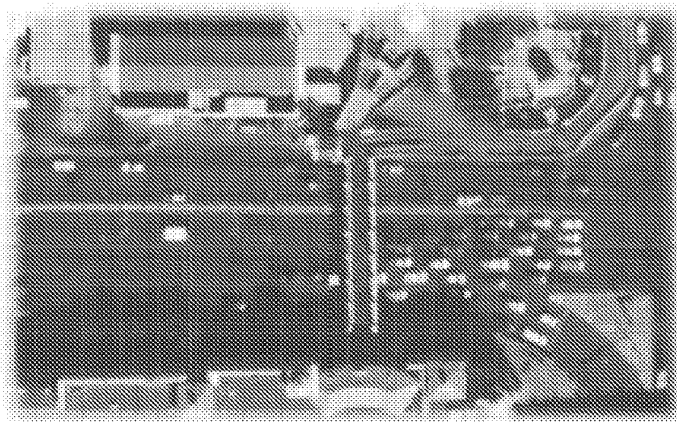


Fig. 7

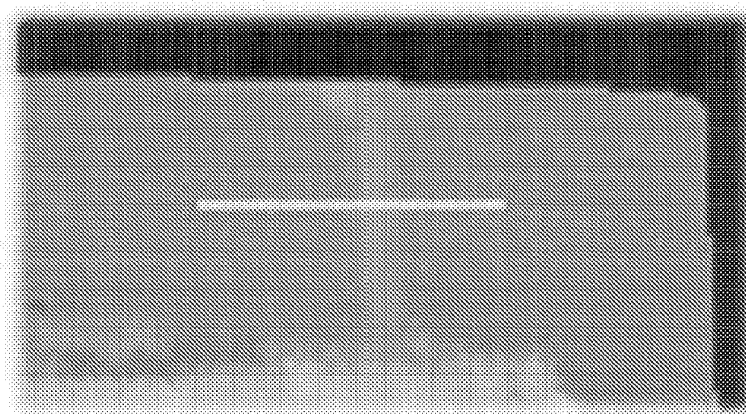


Fig. 8

6/29

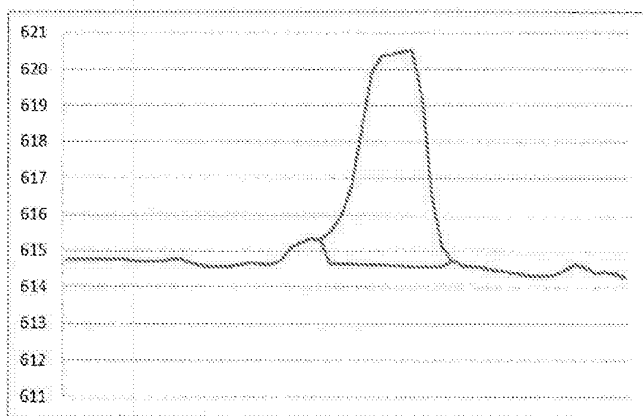


Fig. 9

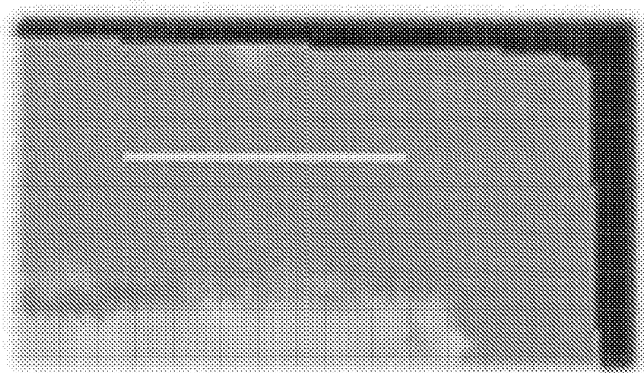


Fig. 10

7/29

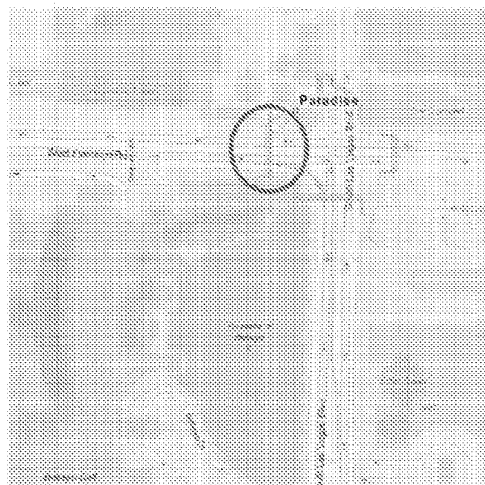


Fig. 11

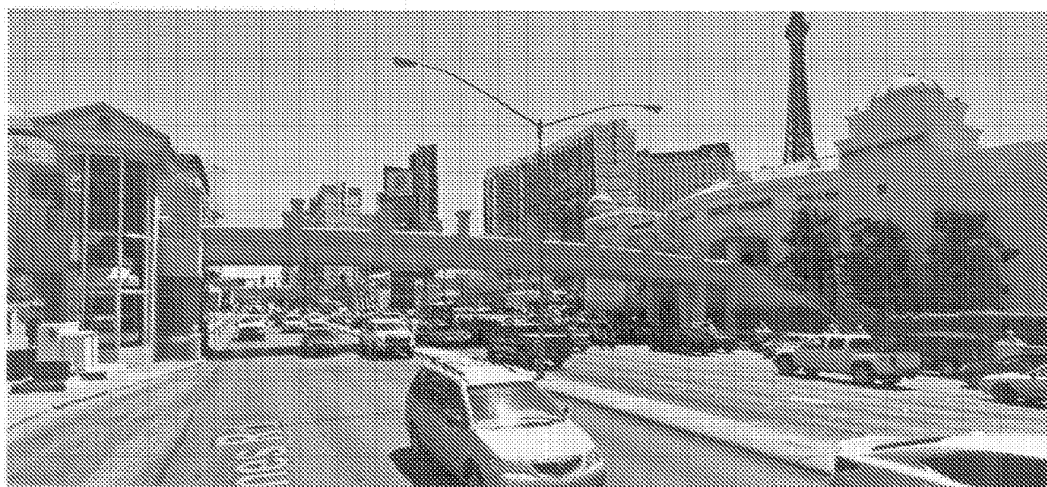


Fig. 12

8/29

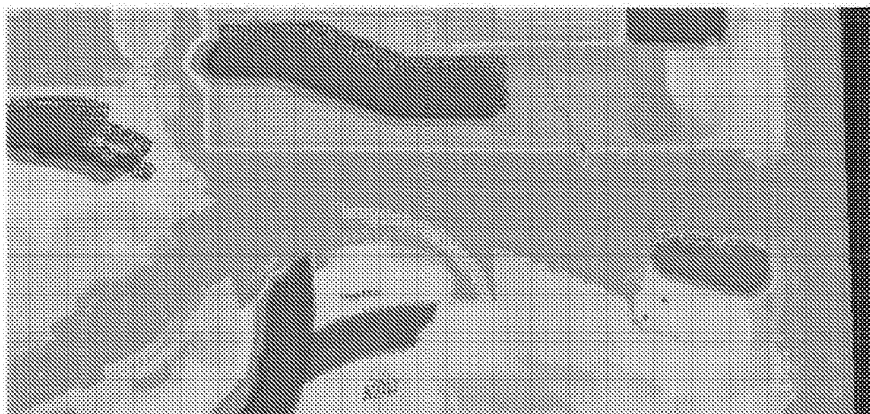


Fig. 13



Fig. 14

9/29

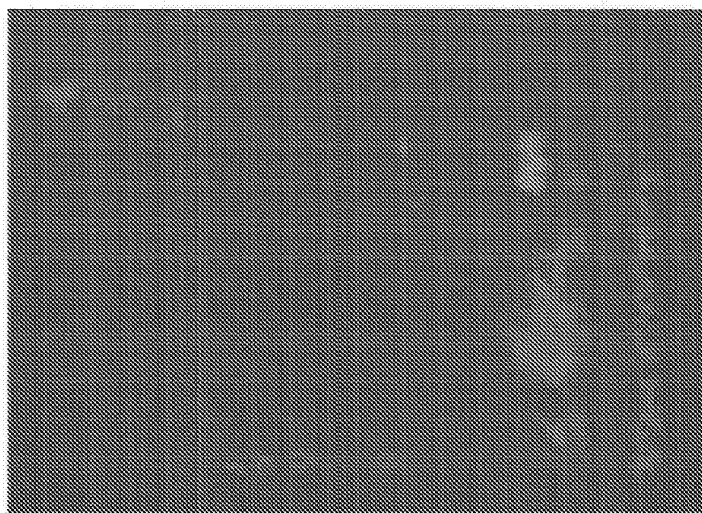


Fig. 15



Fig. 16

10/29

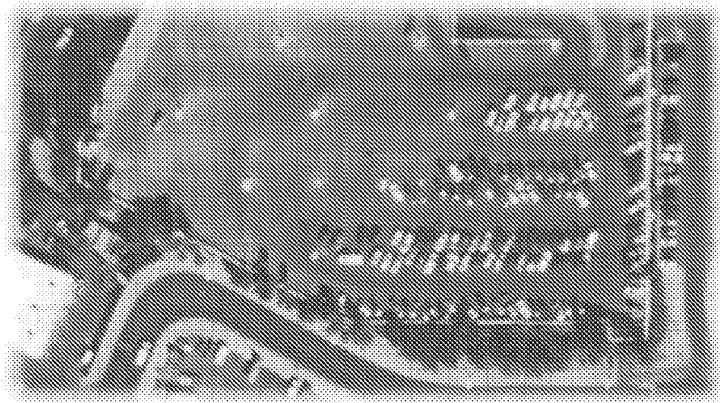


Fig. 17



Fig. 18

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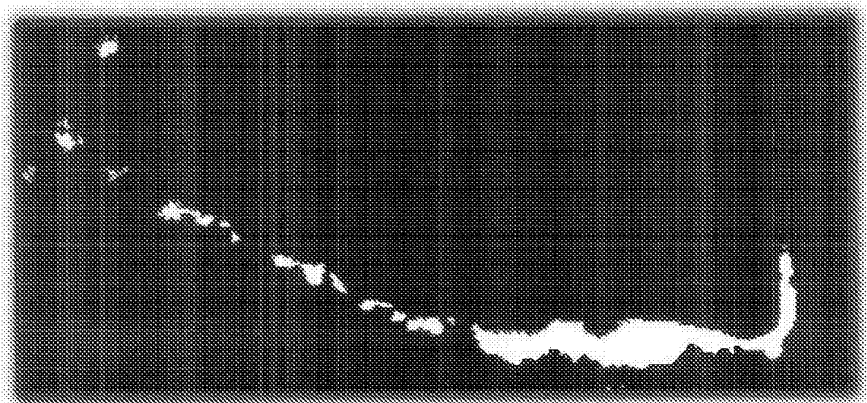


Fig. 19



Fig. 20

12/29

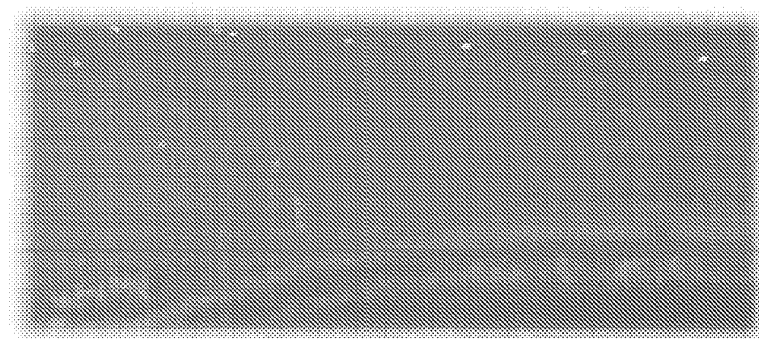


Fig. 21

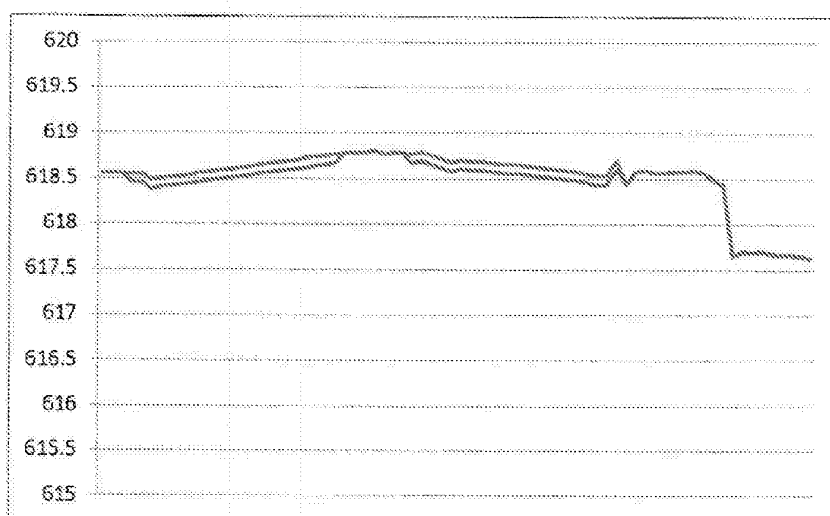


Fig. 22

13/29

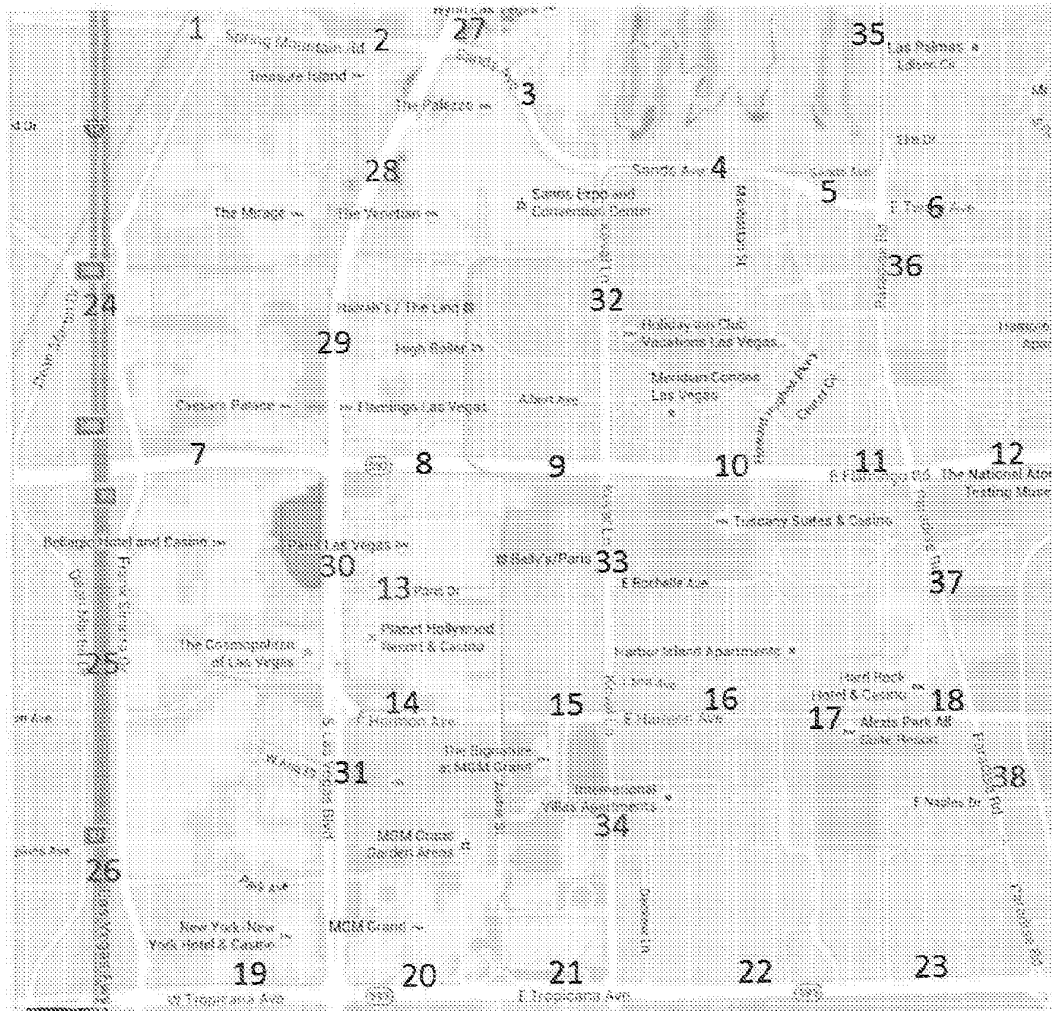


Fig. 23

14/29

Location		Direction	
Map No.		North	South
1	Spring Mountain Road	5cm	20cm
2	Sands Avenue (a)	5cm	5cm
3	Sands Avenue (b)	5cm	5cm
4	Sands Avenue (c)	5cm	5cm
5	Sands Avenue (d)	5cm	5cm
6	E Twain Ave	5cm	5cm
7	Dunes Rd	5cm	5cm
8	E Flamingo Rd (a)	5cm	5cm
9	E Flamingo Rd (b)	5cm	5cm
10	E Flamingo Rd (c)	5cm	5cm
11	E Flamingo Rd (d)	5cm	5cm
12	E Flamingo Rd (e)	5cm	5cm
13	Paris Drive	5cm	5cm
14	E Harmon Ave (a)	5cm	5cm
15	E Harmon Ave (b)	5cm	5cm
16	E Harmon Ave (c)	5cm	5cm
17	E Harmon Ave (d)	5cm	5cm
18	E Harmon Ave (e)	5cm	5cm
19	W Tropicana Ave (a)	5cm	5cm
20	W Tropicana Ave (b)	5cm	5cm
21	W Tropicana Ave (c)	5cm	5cm
22	W Tropicana Ave (d)	5cm	5cm
23	W Tropicana Ave (e)	5cm	5cm
24	Las Vegas Fwy (a)	40cm	40cm
25	Las Vegas Fwy (b)	5cm	5cm
26	Las Vegas Fwy (c)	5cm	5cm
27	S Las Vegas Blvd (a)	5cm	5cm
28	S Las Vegas Blvd (b)	5cm	5cm
29	S Las Vegas Blvd (c)	5cm	5cm
30	S Las Vegas Blvd (d)	5cm	5cm
31	S Las Vegas Blvd (e)	0cm	40cm
32	Koval Lane (a)	5cm	5cm
33	Koval Lane (b)	5cm	5cm
34	Koval Lane (c)	5cm	5cm
35	Paridise Road (a)	5cm	10cm
36	Paridise Road (b)	5cm	5cm
37	Paridise Road (c)	5cm	5cm
38	Paridise Road (d)	5cm	5cm

Fig. 24

15/29



Fig. 25

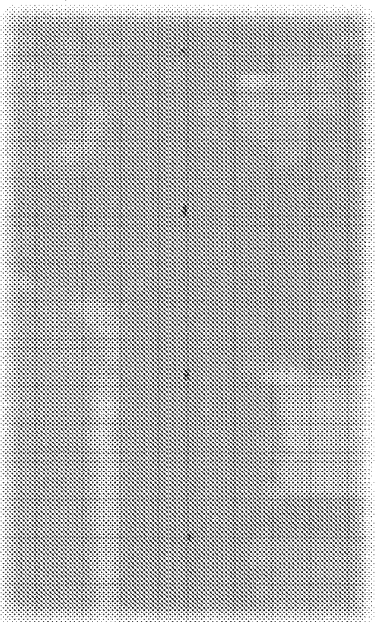


Fig. 26

16/29



Fig. 27



Fig. 28

17/29



Fig. 29

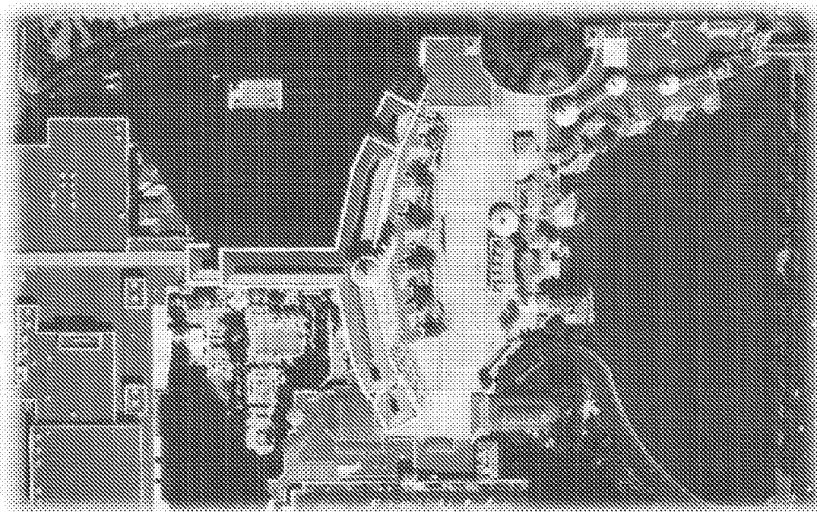


Fig. 30

18/29

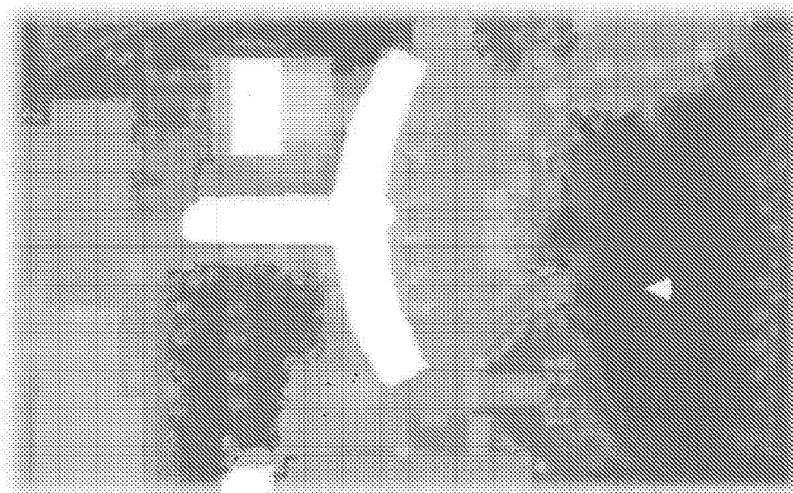


Fig. 31

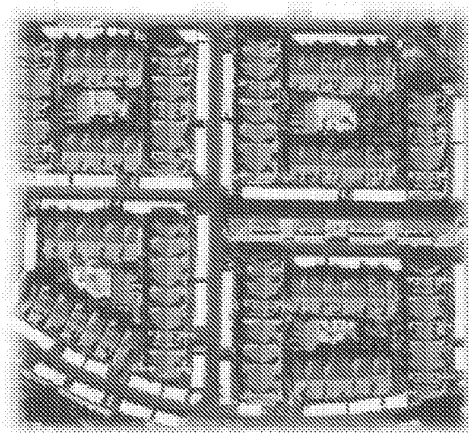


Fig. 32

19/29

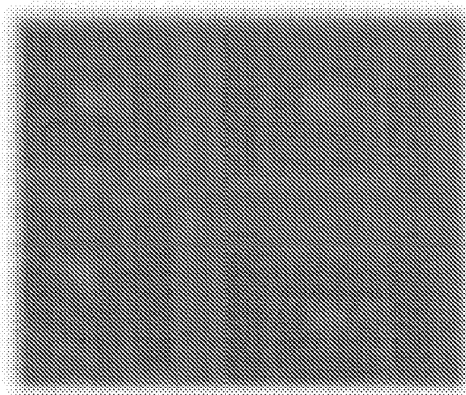


Fig. 33

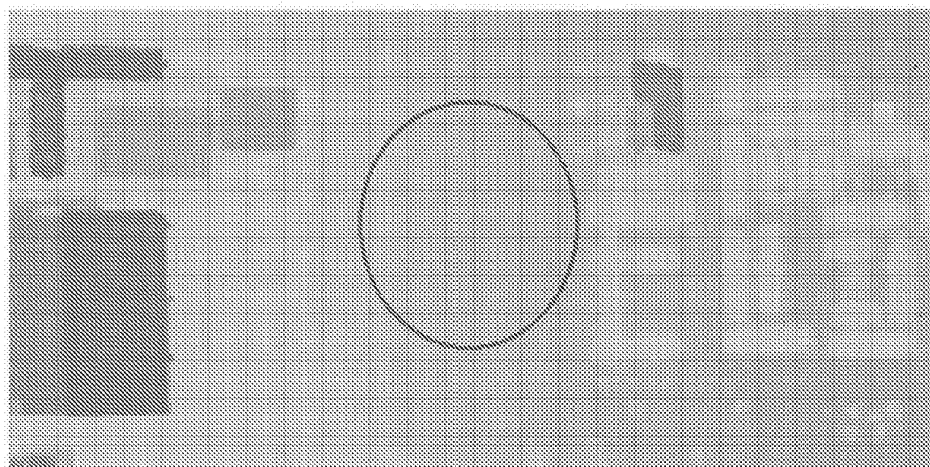


Fig. 34

20/29

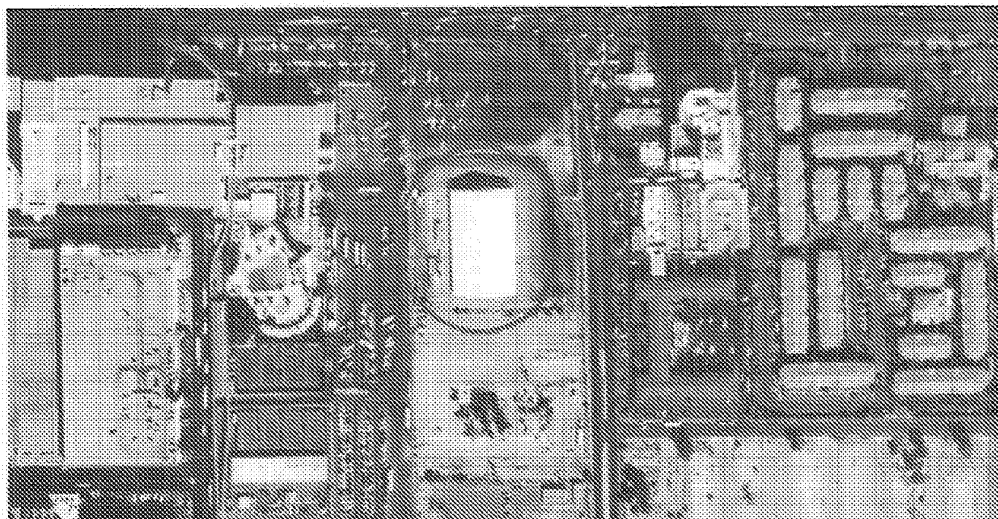


Fig. 35

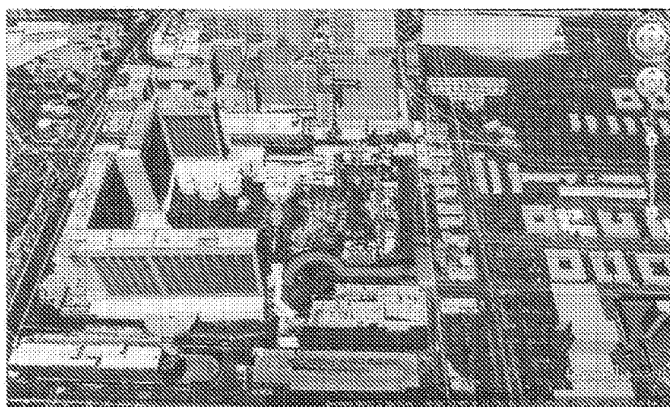


Fig. 36

21/29



Fig. 37

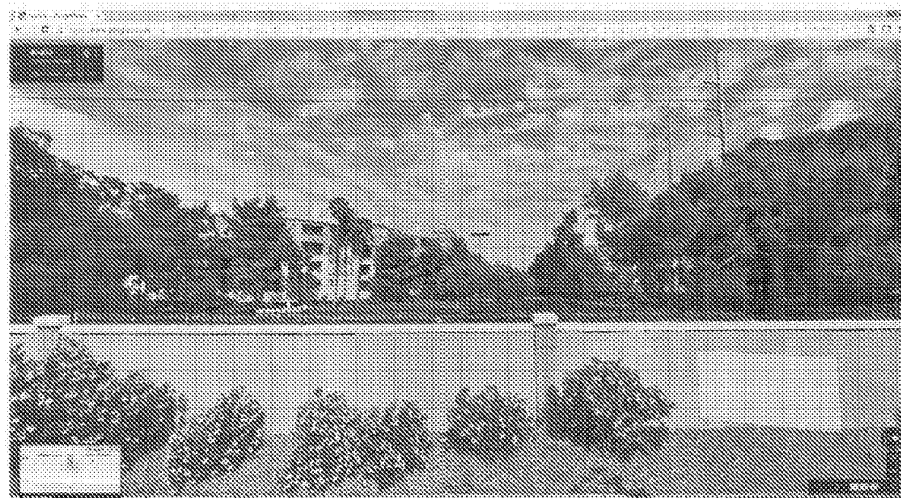


Fig. 38

22/29

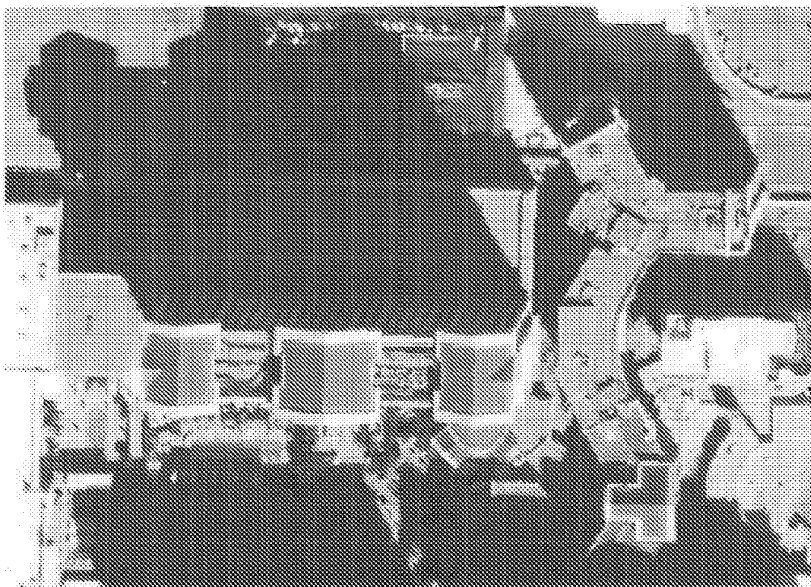


Fig. 39

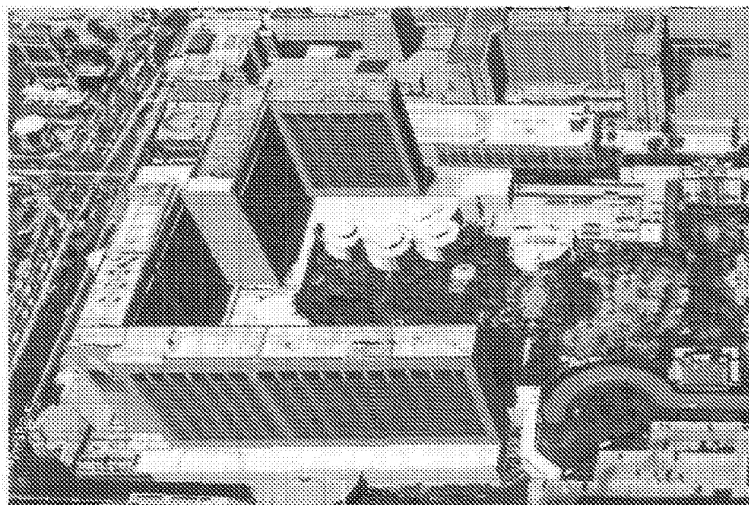


Fig. 40

23/29



Fig. 41

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Legend	
Flood depth (m)	
	0.1 - 0.2
	0.2 - 0.3
	0.3 - 0.5
	0.5 - 1
	1 - 2
	> 2

Fig. 42

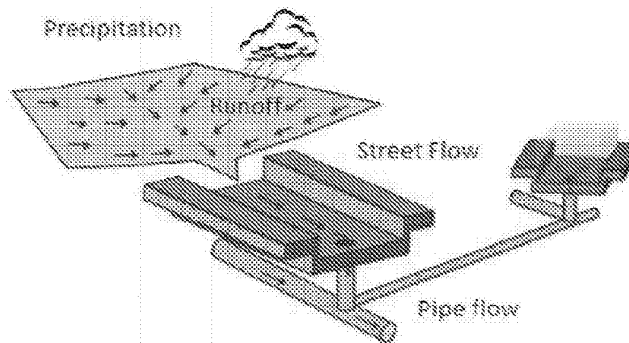


Fig. 43

26/29

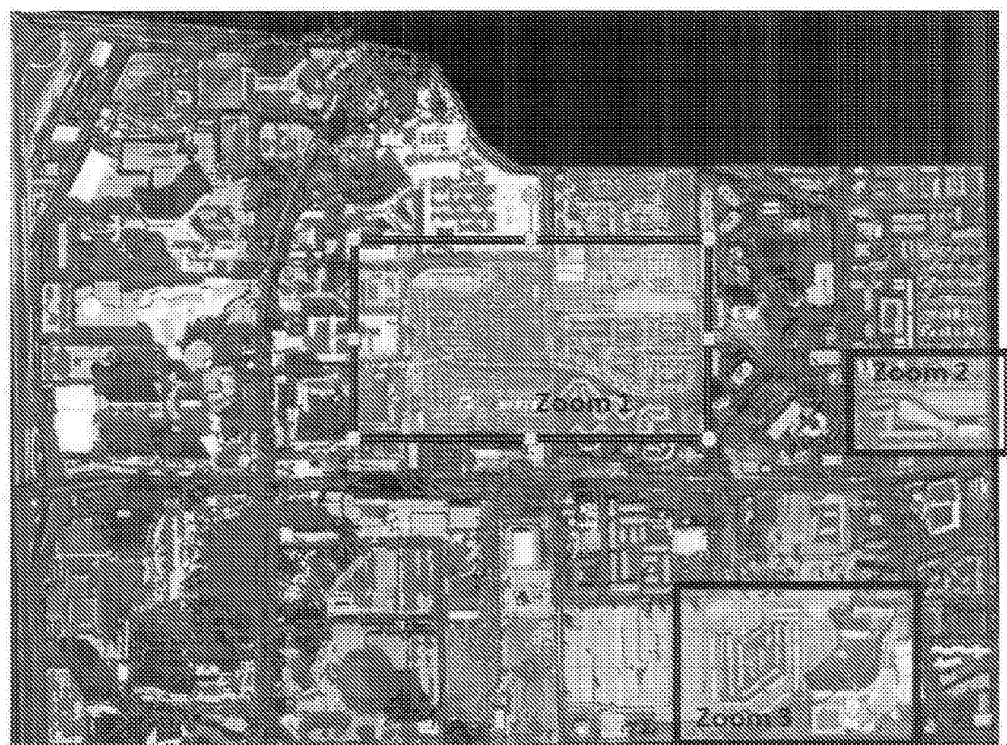


Fig. 45

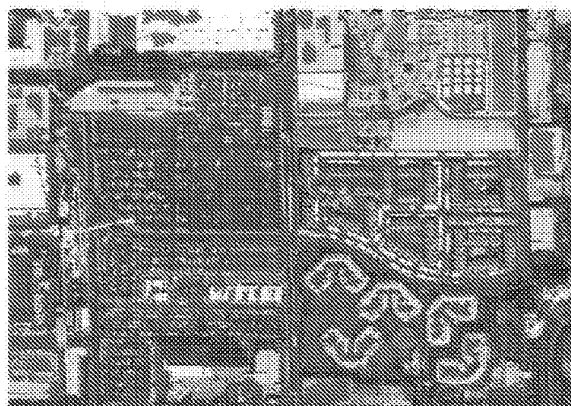


Fig. 46

27/29

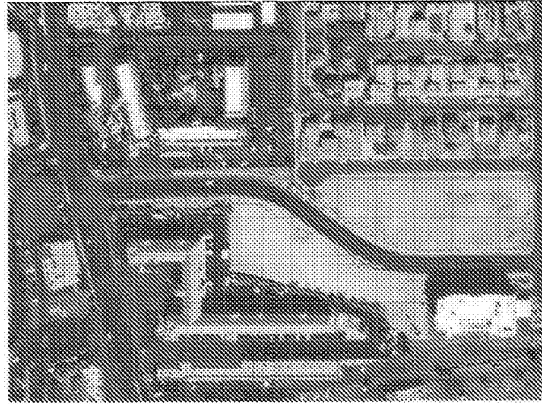


Fig. 47

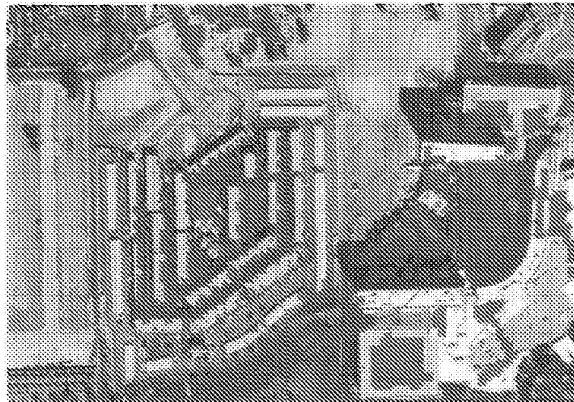


Fig. 48

28/29

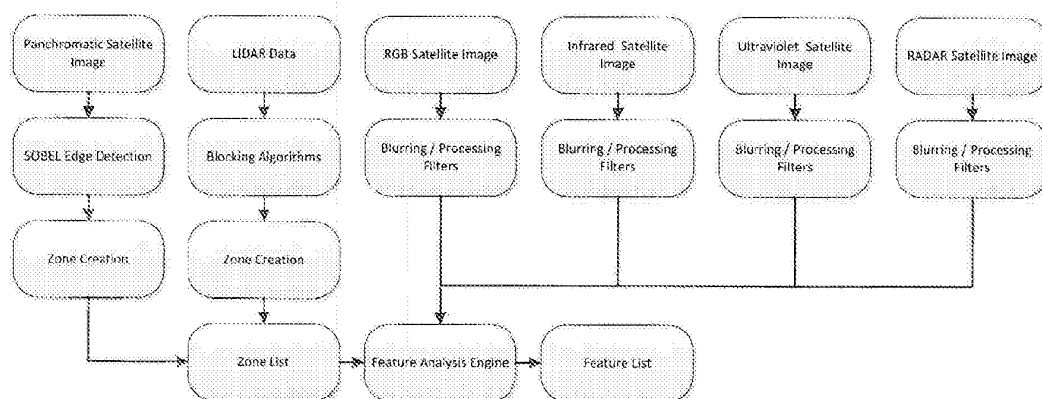


Fig. 49

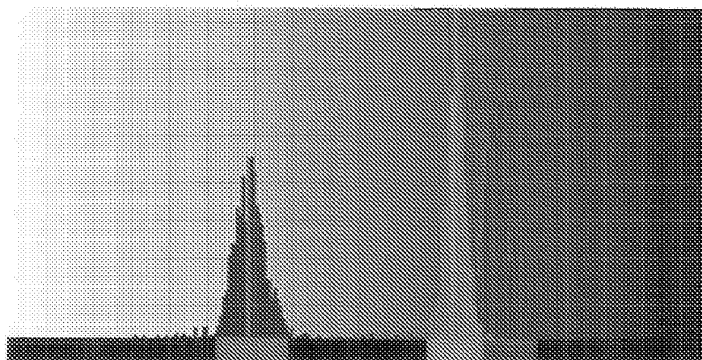


Fig. 50

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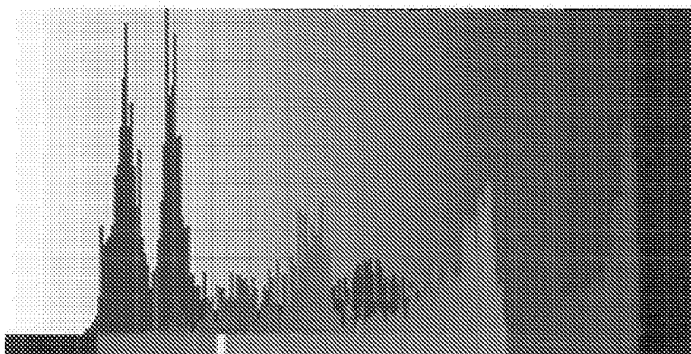


Fig. 51



Fig. 52

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2016/051706

A. CLASSIFICATION OF SUBJECT MATTER			
INV.	GOIM/10	GOICII/00	G01C13/00 G09B29/00 G06Q10/06
ADD.			
According to International Patent Classification (IPC) or to both national classification and IPC			
B. FIELDS SEARCHED			
Minimum documentation searched (classification system followed by classification symbols)			
G01C	G01W	G06Q	G09B
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched			
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)			
EPO-Internal , WPI Data			
C. DOCUMENTS CONSIDERED TO BE RELEVANT			
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	
X	CEDO MAKSIMOVIC ET AL: "Overl and flow and pathway analysi s for modelling of urban pluvi al floodi ng" , JOURNAL OF HYDRAULIC RESEARCH , vol . 47, no. 4, July 2009 (2009-07) , pages 512-523 , XP055304241 , ISSN : 0022-1686, DOI : 10.1080/00221686.2009 .9522027 cited in the applicati on the whole document	1-32	
X	US 2014/164306 A1 (DATTA ANKUR [US] ET AL) 12 June 2014 (2014-06-12)	1-7 , 9-23 , 25-32	
A	paragraphs [0032] , [0038] , [0045] ----- -/--	8,24	
☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.			
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) on which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family			
Date of the actual completion of the international search		Date of mailing of the international search report	
3 October 2016		07/11/2016	
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Kuhn , Robert	

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2016/051706

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2011/295575 AI (LEVINE DAVID A [US] ET AL) 1 December 2011 (2011-12-01)	1-7 , 9-15 , 17-23 , 25-31
A	paragraphs [0029] , [0030] , [0053] , [0107] - [0110] figures 1, 7	8, 16, 24, 32
X	US 2014/003672 AI (MCWETHY LESLIE G [US] ET AL) 2 January 2014 (2014-01-02)	1-7 , 9-23 , 25-32
A	paragraphs [0002] - [0005] , [0014] - [0016] , [0032] , [0033] ; figure 1	8, 24
A	N Simoes ET AL: "Urban drainage models for flood forecasting: 1D/1D, 1D/2D and hybrid models", , 16 September 2011 (2011-09-16) , pages 11-16, XP055304240, 12th International Conference on Urban Drainage, Porto Alegre, Brazil Retrieved from the Internet: URL: https://web.sbe.hw.ac.uk/staffprof/files /bdgsa/temp/12th%20ICUD/PDF/PAP005362.pdf [retrieved on 2016-09-20] cited in the application figure 4	1-32

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2016/051706

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2014164306	AI	12-06 -2014	NONE

us 2011295575	AI	01-12 -2011	CA 2800867 AI 01-12-2011
		CN 103003818 A 27-03-2013	
		EP 2577532 A2 10-04-2013	
		US 2011295575 AI 01-12-2011	
		US 2016179994 AI 23-06-2016	
		Wo 2011150319 A2 01-12-2011	

us 2014003672	AI	02-01 -2014	AR 091585 AI 11-02-2015
		US 2014003672 AI 02-01-2014	
		UY 34879 A 31-01-2014	
		Wo 2014004319 A2 03-01-2014	

Electronic Acknowledgement Receipt

EFS ID:	38455598
Application Number:	16733888
International Application Number:	
Confirmation Number:	5317
Title of Invention:	Platform, Systems, and Methods for Identifying Property Characteristics and Property Feature Conditions Through Aerial Imagery Analysis
First Named Inventor/Applicant Name:	Takeshi Okazaki
Customer Number:	146018
Filer:	Natalie J. Grace/Anthony Gorney
Filer Authorized By:	Natalie J. Grace
Attorney Docket Number:	474139US02
Receipt Date:	31-JAN-2020
Filing Date:	03-JAN-2020
Time Stamp:	12:17:16
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment		no			
File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	2020-01-31_Aon_474139US02_IDS_Transmittal_Letter.pdf	15017	no	1
			1f6a80b85be9062058c14705625c5286e96064ba		
Warnings:					

Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	474139US02_IDS_Form.pdf	1072818	no	5
			82e1e2b800a6f3a5441f2b90f8e04288799a3a27		
Warnings:					
Information:					
3	Foreign Reference	FP_WO2016198873A1.pdf	5802861	no	74
			7ed4477bce4027b5a7d94233c056757c03a3aa3df		
Warnings:					
Information:					
4	Non Patent Literature	NPL_BuiltWorlds.pdf	920981	no	6
			bbcab7e41848b119882d918e642138bd32db7e62		
Warnings:					
Information:					
5	Non Patent Literature	NPL_Buscombe_et_al.pdf	1034044	no	23
			50151fcd67e774ae54c73ad55a6453598b6a5539		
Warnings:					
Information:					
6	Non Patent Literature	NPL_Ham_et_al.pdf	665491	no	8
			d11506fab174823e034645c6b10a6331853e31f8		
Warnings:					
Information:					
7	Non Patent Literature	NPL_Kerle_et_al.pdf	675304	no	7
			b197e55eaf2874d350c200dd6e04bac997a831ce		
Warnings:					
Information:					
8	Non Patent Literature	NPL_Nia_et_al.pdf	487029	no	8
			e5903f7897fa85bda5967f50aa8738c3f07d839c		
Warnings:					
Information:					

9	Non Patent Literature	NPL_Pierdicca_et_al.pdf	473739	no	8
			eb7a65cdb2ab724c578040247eec70df9ce889c4		
Warnings:					
Information:					
10	Non Patent Literature	NPL_Rakha_et_al.pdf	2569176	no	14
			5abf36b127e91533730ebf8d01c650543f5f584c		
Warnings:					
Information:					
11	Non Patent Literature	NPL_Sheppard_et_al.pdf	757636	no	4
			152a7c0d44865a58274174997743c026b4640a26		
Warnings:					
Information:					
12	Non Patent Literature	NPL_Thiele_et_al.pdf	1225883	no	6
			e82ec64b4e661ed6e49956691b3c1e183d7abed3		
Warnings:					
Information:					
13	Non Patent Literature	NPL_Ye_et_al.pdf	366404	no	8
			351dc295b160155e736e8e67d6ffae3b8b60a140		
Warnings:					
Information:					
14	Non Patent Literature	NPL_Zhang_et_al.pdf	1495202	no	6
			a4bced4221c51ef9c7d38b092f82bd4ca6c15d5d		
Warnings:					
Information:					
Total Files Size (in bytes):			17561585		

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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE APPLICATION OF:	
AON BENFIELD INC.	EXAMINER: UNASSIGNED
APPLICATION NO.: 16/733,888	GROUP ART UNIT: 3694
FILED: JANUARY 3, 2020	DOCKET NO. 474139US02
FOR: PLATFORM, SYSTEMS, AND METHODS FOR IDENTIFYING PROPERTY CHARACTERISTICS AND PROPERTY FEATURE CONDITIONS THROUGH AERIAL IMAGERY ANALYSIS	

INFORMATION DISCLOSURE STATEMENT

MAIL STOP AMENDMENT
COMMISSIONER FOR PATENTS
P.O. BOX 1450
ALEXANDRIA, VIRGINIA 22313

Commissioner:

Applicant wishes to make of record the reference(s) listed on the attached PTO/SB/08a form. This Information Disclosure Statement is being submitted prior to the issuance of the first action of the merits in the above-referenced application. Consequently, no certification or fee is required. If, however, any fees are required, then the Commissioner is authorized to charge such fees to Gardella Grace P.A. deposit account number 601484, referencing docket number 474139US02.

Respectfully submitted,

Date: January 31, 2020

/Natalie J. Grace/
Natalie J. Grace
Attorney of Record
Registration No. 65,803

GARDELLA GRACE P.A.
80 M Street SE, 1st Floor
Washington, DC 20003
Telephone: (703) 556-9600
Facsimile: (703) 740-4541



UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/733,888	01/03/2020	Takeshi Okazaki	474139US02	5317
146018	7590	02/04/2020		
Gardella Grace P.A. 80 M Street SE, 1st Floor Washington, DC 20003			EXAMINER	
			ART UNIT	PAPER NUMBER
			3694	
			NOTIFICATION DATE	DELIVERY MODE
			02/04/2020	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):

docketing@gardellagrace.com
nrgace@gardellagrace.com

<i>Decision Granting Request for Prioritized Examination (Track I)</i>	Application No. 16/733,888	Applicant(s) Okazaki, Takeshi	
	Examiner CHERYL P GIBSON BAYLOR	Art Unit OPET	AIA (FITF) Status Yes
<p>1. THE REQUEST FILED <u>03 January 2020</u> IS GRANTED .</p> <p>The above-identified application has met the requirements for prioritized examination</p> <p>A. ☒ for an original nonprovisional application (Track I).</p> <p>B. ☐ for an application undergoing continued examination (RCE).</p> <p>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:</p> <p>A. filing a <u>petition for extension of time</u> to extend the time period for filing a reply;</p> <p>B. filing an <u>amendment to amend the application to contain more than four independent claims, more than thirty total claims</u>, or a multiple dependent claim;</p> <p>C. filing a <u>request for continued examination</u> ;</p> <p>D. filing a notice of appeal;</p> <p>E. filing a request for suspension of action;</p> <p>F. mailing of a notice of allowance;</p> <p>G. mailing of a final Office action;</p> <p>H. completion of examination as defined in 37 CFR 41.102; or</p> <p>I. abandonment of the application.</p> <p>Telephone inquiries with regard to this decision should be directed to CHERYL GIBSON BAYLOR at (571)272-3213. In his/her absence, calls may be directed to Petition Help Desk at (571) 272-3282.</p>			
/CHERYL GIBSON BAYLOR/ Paralegal Specialist, OPET			



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www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/733,888	01/03/2020	Takeshi Okazaki	474139US02	5317
146018	7590	03/19/2020		
Gardella Grace P.A. 80 M Street SE, 1st Floor Washington, DC 20003			EXAMINER NGUYEN, TIEN C	
			ART UNIT 3694	PAPER NUMBER
			NOTIFICATION DATE 03/19/2020	DELIVERY MODE 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):

docketing@gardellagrace.com

ngrace@gardellagrace.com

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

Status of the Claims

1. This action is in response to the application filed on 1/3/2020.
2. Claims 1-20 are pending and examined below.

Claim Objections

3. Claim 5 is objected to because of the following informalities: claim 5 recites the limitation "CNN". The acronym "CNN" need to be spelled out. What is the "CNN" stand for? Appropriate correction is required.

Double Patenting

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

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting

ground provided the reference application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The USPTO internet Web site contains terminal disclaimer forms which may be used. Please visit <http://www.uspto.gov/forms/>. The filing date of the application will determine what form should be used. A web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal Disclaimer that meets all requirements is auto-processed and approved immediately upon submission. For more information about eTerminal Disclaimers, refer to <http://www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp>.

Claims 1-20 of the claimed invention are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-20 of U.S. Patent No. 10,529,029. Although the claims at issue are not identical, they are not patentably distinct from each other because they both disclose a method and a system for automatically categorizing a condition of a characteristic of a property, the method comprising: obtaining, by processing circuitry, an aerial image of a geographic region including the property; extracting, by the processing circuitry, one or more features of a plurality of features from the aerial image, wherein the one or more features are each represented by a set of pixel groupings, and the one or more features represent the characteristic of the property, wherein each pixel grouping of the set of pixel groupings comprises at least one of angles, outlines, or substantially homogenous pixel fields; applying, by the processing circuitry, a first portion of the set of pixel groupings to a first machine learning classifier to determine a characteristic classification of the characteristic from a plurality of potential classifications of the characteristic, wherein the first machine learning classifier is trained to identify at least a portion of the one or more features from the first portion of the set of pixel groupings; and applying, by the processing circuitry, a second portion of the set of pixel groupings to a second machine learning classifier to determine a condition

classification of the characteristic from a plurality of potential condition classifications of the characteristic, wherein the second machine learning classifier is trained to identify, from the second portion of the set of pixel groupings, property characteristic conditions of the characteristic having the characteristic classification.

Conclusion

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to TIEN C. NGUYEN whose telephone number is 571-270-5108. The examiner can normally be reached on Monday-Thursday (6am-2pm EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bennett Sigmond can be reached on 303-297-4411. The fax phone number for the organization where this application or proceeding is assigned is 571-270-6108.

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.

Any response to this action should be mailed to:

Commissioner of Patents and Trademarks

P.O. Box 1450 Alexandria, VA 22313-1450

or faxed to 571-273-8300.

Hand delivered responses should be brought to the United States Patent and Trademark Office Customer Service Window:

Application/Control Number: 16/733,888
Art Unit: 3694

Page 5

Randolph Building 401 Dulany Street Alexandria, VA 22314.

--

/TIEN C NGUYEN/
Primary Examiner, Art Unit 3694

<i>Notice of References Cited</i>	Application/Control No. 16/733,888	Applicant(s)/Patent Under Reexamination Okazaki, Takeshi	
	Examiner TIEN C NGUYEN	Art Unit 3694	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-6732120-B1	05-2004	Du; Mike	G01C21/20	715/764
*	B	US-8775219-B2	07-2014	Swanson; Aaron L.	G06Q50/16	705/4
*	C	US-20090265193-A1	10-2009	COLLINS; Dean	G06Q30/0185	705/4
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	E					
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*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
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*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
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Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

<i>Search Notes</i> 	Application/Control No. 16/733,888	Applicant(s)/Patent Under Reexamination Okazaki, Takeshi
	Examiner TIEN C NGUYEN	Art Unit 3694

CPC - Searched*		
Symbol	Date	Examiner
G06Q	03/16/2020	/tn/

CPC Combination Sets - Searched*		
Symbol	Date	Examiner
G 06Q 40/08, G 06Q 40/02, G 06Q 10/10, G 06F19/328, G 06Q 30/02.	03/16/2020	/tn/

US Classification - Searched*			
Class	Subclass	Date	Examiner
705	4	03/16/2020	/tn/
705	5	03/16/2020	/tn/
705	39	03/16/2020	/tn/
705	37	03/16/2020	/tn/
705	38	03/16/2020	/tn/
705	40	03/16/2020	/tn/

* 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
Updated East and PALM.	03/16/2020	/tn/
Google search.	03/16/2020	/tn/
Inventor search.	03/16/2020	/tn/
Search SN# 15/714376	03/16/2020	/tn/

/TIEN C NGUYEN/ Primary Examiner, Art Unit 3694	
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<i>Search Notes</i> 	Application/Control No. 16/733,888	Applicant(s)/Patent Under Reexamination Okazaki, Takeshi
	Examiner TIEN C NGUYEN	Art Unit 3694

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

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Doc code: IDS

Doc description: Information Disclosure Statement (IDS) Filed

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	Filing Date	2020-01-03
	First Named Inventor	Takeshi Okazaki
	Art Unit	3694
	Examiner Name	Not Yet Assigned
	Attorney Docket Number	474139US02

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	1	10275833		2019-04-30	Christopulos et al.	
	2	9152863		2015-10-06	Grant	
	3	10346687		2019-07-09	Pestun et al.	
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	1	20140316614		2014-10-23	Newman	
	2	20180247416		2018-08-30	Ruda et al.	

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	Filing Date		2020-01-03	
	First Named Inventor	Takeshi Okazaki		
	Art Unit	3694		
	Examiner Name	Not Yet Assigned		
	Attorney Docket Number	474139US02		

Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ²	Kind Code ⁴	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear	T ⁵
	1	2016198873	WO		2016-12-15	Smith, Alexis Hannah		

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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	KERLE, et al., Urban Structural Damage Assessment With Oblique UAV Imagery, Object-Based Image Analysis And Semantic Reasoning, 35th Asian Conference On Remote Sensing, October 27, 2014.	
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	4	PIERDICCA, et al., Deep Convolutional Neural Network For Automatic Detection Of Damaged Photovoltaic Cells, The International Archives Of The Photogrammetry, Remote Sensing And Spetial Information Sciences, Volume 42-Number 2, May 30, 2018.	
	5	THIELE, et al., Building Recognition From Multi-Aspect High-Resolution InSAR Data In Urban Areas, IEEE Transactions on Geoscience And Remote Sensing, Volume 45, Issue 11, October 29, 2007, pages 3583-3593.	
	6	BUSCOMBE, et al., Landscape Classification With Deep Neural Networks, Geosciences, Volume 8, Issue 7, July 2018, page 244.	
	7	SHEPPARD, et al., Real-Time Scene Understanding For UAV Imagery Based On Deep Convolutional Neural Networks, 2017 IEEE International Geoscience And Remote Sensing Symposium (IGARSS), July 23, 2017, pages 2243-2246.	

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	Examiner Name	Not Yet Assigned
	Attorney Docket Number	474139US02

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Examiner Signature	/TIEN C NGUYEN/	Date Considered	03/15/2020
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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).

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☒ A certification statement is not submitted herewith.

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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	/Natalie J. Grace/	Date (YYYY-MM-DD)	2020-01-31
Name/Print	Natalie J. Grace	Registration Number	65,803

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CONFIRMATION NO. 5317

SERIAL NUMBER 16/733,888	FILING or 371(c) DATE 01/03/2020 RULE	CLASS 705	GROUP ART UNIT 3694	ATTORNEY DOCKET NO. 474139US02		
APPLICANTS Aon Benfield Inc., Chicago, IL INVENTORS Takeshi Okazaki, Tokyo, JAPAN; ** CONTINUING DATA ***** This application is a CIP of 15/714,376 09/25/2017 PAT 10529029 which claims benefit of 62/398,665 09/23/2016 ** FOREIGN APPLICATIONS ***** ** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** 01/24/2020						
Foreign Priority claimed ☐ Yes ☒ No 35 USC 119(a-d) conditions met ☐ Yes ☒ No Verified and Acknowledged <u>/TIEN C. NGUYEN/</u> Examiner's Signature		☐ Met after Allowance Initials	STATE OR COUNTRY JAPAN	SHEETS DRAWINGS 15	TOTAL CLAIMS 22	INDEPENDENT CLAIMS 3
ADDRESS Gardella Grace P.A. 80 M Street SE, 1st Floor Washington, DC 20003 UNITED STATES						
TITLE Platform, Systems, and Methods for Identifying Property Characteristics and Property Feature Conditions Through Aerial Imagery Analysis						
FILING FEE RECEIVED 1920	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:		☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit			

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	Filing Date	2020-01-03
	First Named Inventor	Takeshi Okazaki
	Art Unit	3694
	Examiner Name	Tien Nguyen
	Attorney Docket Number	474139US02

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	1	10311302		2019-06-04	Kottenstette et al.	
	2	9141872		2015-09-22	Marchisio et al.	
	3	9569690		2017-02-14	Marchisio et al.	
	4	9858645		2018-01-02	Malitz	
	5	9031325		2015-05-12	Ouzounis	
	6	8682079		2014-03-25	Ouzounis	
	7	9589210		2017-03-07	Estrada et al.	
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	Filing Date		2020-01-03
	First Named Inventor	Takeshi Okazaki	
	Art Unit		
	Examiner Name		
	Attorney Docket Number		474139US02

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	Examiner Name		
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Application Number		
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First Named Inventor	Takeshi Okazaki	
Art Unit		
Examiner Name		
Attorney Docket Number		474139US02

Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ² i	Kind Code ⁴	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear	T ⁵
	1	2017040691	WO	A1	2017-03-09	CAPE ANALYTICS, INC.	Previously submitted in related appln. no. 15/714,376	
	2	2017151673	WO	A1	2017-09-08	DIGITALGLOBE, INC.	Previously submitted in related appln. no. 15/714,376	
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	4	2015017366	WO	A1	2015-02-05	DIGITALGLOBE, INC.	Previously submitted in related appln. no. 15/714,376	
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	7	2014151122	WO	A1	2014-09-25	EAGLE VIEW TECHNOLOGIES, INC.	Previously submitted in related appln. no. 15/714,376	
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	First Named Inventor	Takeshi Okazaki		
	Art Unit			
	Examiner Name			
	Attorney Docket Number	474139US02		

11	2013142406	WO	A1	2013-09-26	PICTOMETRY INTERNATIONAL CORP.	Previously submitted in related appln. no. 15/714,376
12	2017186515	WO	A1	2017-11-02	SIEMENS AKTIENGESELLSCHAFT	Previously submitted in related appln. no. 15/714,376
13	2013123354	WO	A1	2013-08-22	XACTWARE SOLUTIONS, INC.	Previously submitted in related appln. no. 15/714,376
14	2015017855	WO	A1	2015-02-05	XACTWARE SOLUTIONS, INC.	Previously submitted in related appln. no. 15/714,376
15	2018058044	WO	A1	2018-03-29	AON BENFIELD INC.	Previously submitted in related appln. no. 15/714,376

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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	International Search Report and Written Opinion issued in International Application No. PCT/US2017/053265 on December 11, 2017. (Previously submitted in related appln. no. 15/714,376)	
	2	International Patent Report on Patentability issued in International Application No. PCT/US2017/053265 on March 26, 2019. (Previously submitted in related appln. no. 15/714,376)	
	3	LIN, et al., Network in Network, International Conference on Learning Representations, 2014, pp. 10. (Previously submitted in related appln. no. 15/714,376)	
	4	KRIZHEVSKY, et al., ImageNet Classification with Deep Convolutional Neural Networks, Advances in neural information processing systems, 2012, pp. 9. (Previously submitted in related appln. no. 15/714,376)	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		
	Filing Date		2020-01-03
	First Named Inventor	Takeshi Okazaki	
	Art Unit		
	Examiner Name		
	Attorney Docket Number		474139US02

5	Non-Final Office Action mailed in U.S. Appln. No. 15/714,376, dated March 21, 2019. (Submitted herewith)
6	Notice of Allowance mailed in U.S. Appln. No. 15/714,376, dated August 7, 2019. (Submitted herewith)
7	Notice of Allowance mailed in U.S. Appln. No. 15/714,376, dated November 20, 2019. (Submitted herewith)
8	Systems and Methods for Insurers to Monitor Continuously Structural Status of Insured Homes, IP.com Number: IPCOM000177511D, December 16, 2008. (Year: 2008) (Previously submitted in related appln. no. 15/714,376 by Examiner)

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Examiner Signature	/TIEN C NGUYEN/	Date Considered	03/15/2020
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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		
	Filing Date		2020-01-03
	First Named Inventor	Takeshi Okazaki	
	Art Unit		
	Examiner Name		
	Attorney Docket Number	474139US02	

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	/Natalie J. Grace/	Date (YYYY-MM-DD)	2020-01-03
Name/Print	Natalie J. Grace	Registration Number	65803

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

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

Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (02-18)

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

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

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	16/733888
	Filing Date	2020-01-03
	First Named Inventor	Takeshi Okazaki
	Art Unit	3694
	Examiner Name	Tien Nguyen
	Attorney Docket Number	474139US02

U.S.PATENTS						Remove
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear
	1	9928553		2018-03-27	Harvey et al.	
	2	10173773		2019-01-08	Flick	
	3	10137984		2018-11-27	Flick	
	4	10163164		2018-12-25	Tofte et al.	
	5	9501700		2016-11-22	Loveland et al.	
	6	9679227		2017-06-13	Taylor et al.	
	7	10453147		2019-10-22	Davis	
	8	6732120	B1	2004-05-04	Du	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number			
	Filing Date		2020-01-03	
	First Named Inventor	Takeshi Okazaki		
	Art Unit			
	Examiner Name			
	Attorney Docket Number		474139US02	

	9	9846915	B2	2017-12-19	Howe et al.	
	10	8346578	B1	2013-01-01	Hopkins, III et al.	

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U.S.PATENT APPLICATION PUBLICATIONS

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	Filing Date		2020-01-03
	First Named Inventor	Takeshi Okazaki	
	Art Unit		
	Examiner Name		
	Attorney Docket Number		474139US02

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Examiner Signature	/TIEN C NGUYEN/		Date Considered
			03/15/2020
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<small> 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. </small>			

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		
	Filing Date		2020-01-03
	First Named Inventor	Takeshi Okazaki	
	Art Unit		
	Examiner Name		
	Attorney Docket Number	474139US02	

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☒ A certification statement is not submitted herewith.

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Signature	/Natalie J. Grace/	Date (YYYY-MM-DD)	2020-01-03
Name/Print	Natalie J. Grace	Registration Number	65803

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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.
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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	11	("2012/0038633").URPN.	USPAT	OR	ON	2020/03/16 06:32
L2	492	(extract\$3) with ((aerial\$3) near7 (imag\$3))	USPAT	OR	ON	2020/03/16 06:33
L3	44236	pixel\$3 near7 (group\$3 or grouping\$3)	USPAT	OR	ON	2020/03/16 06:33
L4	59	L2 and L3	USPAT	OR	ON	2020/03/16 06:33
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S2	142259	(property or properties or house or houses or "real property" or resident\$3) near7 (characteristic\$3 or identification\$3)	USPAT	OR	ON	2020/03/16 05:29
S3	7105	S1 and S2	USPAT	OR	ON	2020/03/16 05:29
S4	8039	aerial\$3 near7 imag\$3	USPAT	OR	ON	2020/03/16 05:29
S5	46894	(geographic\$3) near7 (region\$3 or boundar\$3)	USPAT	OR	ON	2020/03/16 05:30
S6	791	S4 and S5	USPAT	OR	ON	2020/03/16 05:30
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S9	134	("5193185" "5214757" "5418906" "5426780" "5751612" "5953722" "5963956" "5968109" "5974419" "6047280" "6282489").PN. OR ("6732120").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2020/03/16 05:32
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EAST Search History

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EAST Search History

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S23	449	(extract\$3) with ((aerial\$3) near7 (imag\$3))	USPAT	OR	ON	2020/03/16 10:32
S24	41745	pixel\$3 near7 (group\$3 or grouping\$3)	USPAT	OR	ON	2020/03/16 10:33
S25	54	S23 and S24	USPAT	OR	ON	2020/03/16 10:33
S26	6016	(property or properties or house or houses or "real property" or resident\$3) near7 (classif\$3)	USPAT	OR	ON	2020/03/16 10:34
S27	1	S25 and S26	USPAT	OR	ON	2020/03/16 10:34
S28	47173	(risk\$3 or damag\$3) near7 (estimat\$3 or determin\$3)	USPAT	OR	ON	2020/03/16 10:35
S29	1	S27 and S28	USPAT	OR	ON	2020/03/16 10:35
S30	40	("20050251427" "20060095304" "20080103841" "20090063234" "20090265193" "20090276708" "20100179787" "20100215212" "20100257477" "20130117078" "20130297353" "20140032433" "20140039935" "20140149144" "20150332355" "20160086285" "6098070" "6219930" "7676061" "8078875" "8170840" "8209152" "8346578" "8401222" "8401877" "8515125" "8670961" "8731234" "8756085" "8774525" "8775219" "8818572" "8818770" "8825454" "8874454" "8929586" "8977520" "8995757" "9002719").PN. OR ("9846915").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2020/03/16 10:38
S31	51	("2623291" "2623292" "3029522" "3890715" "4131998" "4353988" "4389782" "4435769" "4507872" "4517748" "4896428" "5128859" "5293309" "5317503" "5377098" "5491902").PN. OR ("6219930").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2020/03/16 10:39
S32	17	("20020154574" "20040016159" "20040073434" "2431827" "3111736" "3456373" "6219930" "6775935").PN. OR	US-PGPUB; USPAT; USOCR	OR	ON	2020/03/16 10:40

3/16/2020 6:34:30 AM

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EAST Search History

		("7331133").URPN.				
S33	127	("20010041993" "20020055861" "20020072975" "20020120475" "20020133721" "20020158968" "20020161533" "20030028296" "20030112263" "20030120519" "20030154111" "20030233261" "20040039577" "20040044549" "20040103010" "20040128155" "20040133317" "20040186744" "20050046597" "20050083413" "20050108065" "20050125117" "20050131596" "20050146604" "20050251427" "20060114531" "20060132291" "20060155616" "20060200307" "20070061109" "20070100669" "20070247331" "20070250232" "20080046261" "20080189142" "20080222005" "20080267487" "20080281658" "20090002364" "20090015585" "20090018859" "20090092336" "20090138290" "20090150200" "20090265193" "20090290787" "20090318121" "20100057498" "20100214797" "20100293114" "20100316288" "20110022489" "20110026673" "20110041088" "20110060648" "20110093159" "20110209074" "20110218825" "20110264582" "20110313936" "20110313951" "20120029759" "20120109660" "20120131504" "20120136802" "20120245767" "20120297337" "20130080291" "20130177134" "20130317861" "20130325753" "20140074865" "20140081876" "20140082563" "20140085086" "20140095339" "20140201022" "20140316825" "20150012169" "20170147991" "3308845" "3675800" "4569531" "4981318" "5317503" "5343628" "5392388" "5657233" "5673025" "5833294" "5839112" "5853215" "6052631" "6554183" "6843599" "6920197" "7089592" "7331133").PN. OR ("7497618" "7602143" "7636676" "7889931" "7974859" "8061752" "8095394" "8131417" "8151209" "8311856" "8335606" "8407139" "8478480" "8650068" "8712893" "8799034" "8954226" "9020096" "9291544"	US-PGPUB; USPAT; USOCR	OR	ON	2020/03/16 10:40

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		"9292544" "9424606" "9684934" "9791590" "D396455" "D461822" "D722606" "D726741" "D727928").PN. OR ("10304137").URPN.				
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S36	427	("5335265" "5335278" "5345595" "5351290").PN. OR ("5627886").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2020/03/16 10:41
S37	622	("5032979" "5517519" "5579222" "5590245" "5614940" "5619656" "5627886" "5678041" "5696965" "5706507" "5727159" "5796952").PN. OR ("6018619").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2020/03/16 10:41
S38	8	("20140316614" "20150371543" "20160012730" "20160224932" "20160292696" "20170011340" "20170011343" "20170148467").PN. OR ("10102758").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2020/03/16 10:42
S39	8348	aerial\$3 near7 imag\$3	USPAT	OR	ON	2020/03/16 10:42
S40	49314	(geographic\$3) near7 (region\$3 or boundar\$3)	USPAT	OR	ON	2020/03/16 10:42
S41	849	S39 and S40	USPAT	OR	ON	2020/03/16 10:42

3/16/2020 6:34:30 AM

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EAST Search History

S42	6	("20060122776" "20070025595" "20130226667" "20190050625" "20190130641" "9389084").PN. OR ("10339646").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2020/03/16 10:57
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S44	6	("20060122776" "20070025595" "20130226667" "20190050625" "20190130641" "9389084").PN. OR ("10339646").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2020/03/16 10:57
S45	10	("2013/0226667").URPN.	USPAT	OR	ON	2020/03/16 10:57
S46	849	S39 and S40	USPAT	OR	ON	2020/03/16 10:58
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S50	10	("2012/0038633").URPN.	USPAT	OR	ON	2020/03/16 10:59

3/16/2020 6:34:30 AM

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875				Application or Docket Number 16/733,888		Filing Date 01/03/2020		☐ 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	03/23/2020	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR		PRESENT EXTRA		RATE (\$)		ADDITIONAL FEE (\$)			
	Total (37 CFR 1.16(i))	* 22	Minus	** 22	= 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	
AMENDMENT			(Column 1)		(Column 2)		(Column 3)						
			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		LIE	
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.										/TARA A WASHINGTON/			
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".													
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".													
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.													

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

Doc Code: DIST.E.FILE Document Description: Electronic Terminal Disclaimer - Filed		PTO/SB/26 U.S. Patent and Trademark Office Department of Commerce	
Electronic Petition Request	TERMINAL DISCLAIMER TO OBIATE A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT		
Application Number	16733888		
Filing Date	03-Jan-2020		
First Named Inventor	Takeshi Okazaki		
Attorney Docket Number	474139US02		
Title of Invention	Platform, Systems, and Methods for Identifying Property Characteristics and Property Feature Conditions Through Aerial Imagery Analysis		
☒ Filing of terminal disclaimer does not obviate requirement for response under 37 CFR 1.111 to outstanding Office Action ☒ This electronic Terminal Disclaimer is not being used for a Joint Research Agreement.			
Owner		Percent Interest	
AON BENFIELD INC.		100%	
<p>The owner(s) with percent interest listed above in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of prior patent number(s)</p> <p>10529029</p> <p>as the term of said prior patent is presently shortened by any terminal disclaimer. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the prior patent are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.</p> <p>In making the above disclaimer, the owner does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term of the prior patent, "as the term of said prior patent is presently shortened by any terminal disclaimer," in the event that said prior patent later:</p> <ul style="list-style-type: none"> - expires for failure to pay a maintenance fee; - is held unenforceable; - is found invalid by a court of competent jurisdiction; - is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321; - has all claims canceled by a reexamination certificate; - is reissued; or - is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer. <p>☒ Terminal disclaimer fee under 37 CFR 1.20(d) is included with Electronic Terminal Disclaimer request.</p>			

☐ I certify, in accordance with 37 CFR 1.4(d)(4), that the terminal disclaimer fee under 37 CFR 1.20(d) required for this terminal disclaimer has already been paid in the above-identified application.	
Applicant claims the following fee status: ☐ Small Entity ☐ Micro Entity ☒ Regular Undiscounted	
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 further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.	
THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES I certify, in accordance with 37 CFR 1.4(d)(4) that I am: ☒ An attorney or agent registered to practice before the Patent and Trademark Office who is of record in this application Registration Number <u>65803</u> ☐ A sole inventor ☐ A joint inventor; I certify that I am authorized to sign this submission on behalf of all of the inventors as evidenced by the power of attorney in the application ☐ A joint inventor; all of whom are signing this request	
Signature	/Natalie J. Grace/
Name	Natalie J. Grace

*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner).
 Form PTO/SB/96 may be used for making this certification. See MPEP § 324.

Electronic Patent Application Fee Transmittal				
Application Number:		16733888		
Filing Date:		03-Jan-2020		
Title of Invention:		Platform, Systems, and Methods for Identifying Property Characteristics and Property Feature Conditions Through Aerial Imagery Analysis		
First Named Inventor/Applicant Name:		Takeshi Okazaki		
Filer:		Natalie J. Grace/Jon Bhatt		
Attorney Docket Number:		474139US02		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
STATUTORY OR TERMINAL DISCLAIMER	1814	1	160	160
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				160

Doc Code: DISQ.E.FILE

Document Description: Electronic Terminal Disclaimer – Approved

Application No.: 16733888

Filing Date: 03-Jan-2020

Applicant/Patent under Reexamination: Okazaki

Electronic Terminal Disclaimer filed on March 23, 2020

☒ APPROVED

This patent is subject to a terminal disclaimer

☐ DISAPPROVED

Approved/Disapproved by: Electronic Terminal Disclaimer automatically approved by EFS-Web

U.S. Patent and Trademark Office

Electronic Acknowledgement Receipt	
EFS ID:	38943359
Application Number:	16733888
International Application Number:	
Confirmation Number:	5317
Title of Invention:	Platform, Systems, and Methods for Identifying Property Characteristics and Property Feature Conditions Through Aerial Imagery Analysis
First Named Inventor/Applicant Name:	Takeshi Okazaki
Customer Number:	146018
Filer:	Natalie J. Grace/Jon Bhatt
Filer Authorized By:	Natalie J. Grace
Attorney Docket Number:	474139US02
Receipt Date:	23-MAR-2020
Filing Date:	03-JAN-2020
Time Stamp:	17:33:54
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$ 160
RAM confirmation Number	E20203MH33515672
Deposit Account	601484
Authorized User	Jon Bhatt
<p>The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:</p> <p>37 CFR 1.16 (National application filing, search, and examination fees)</p> <p>37 CFR 1.17 (Patent application and reexamination processing fees)</p>	

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	Terminal Disclaimer-Filed (Electronic)	eTerminal-Disclaimer.pdf	33413	no	2
			cde414e13de9b6cac0f08021f6bc75cb5d14fe8		

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	30813	no	2
			5217c791070fab90b4b47c41c9a32b5172e53739		

Warnings:

Information:

Total Files Size (in bytes):	64226
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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

IN RE APPLICATION OF:	
AON BENFIELD INC.	EXAMINER: NGUYEN, TIEN C
APPLICATION NO.: 16/733,888	GROUP ART UNIT: 3694
FILED: JANUARY 3, 2020	DOCKET NO. 474139US02
FOR: PLATFORM, SYSTEMS, AND METHODS FOR IDENTIFYING PROPERTY CHARACTERISTICS AND PROPERTY FEATURE CONDITIONS THROUGH AERIAL IMAGERY ANALYSIS	

AMENDMENT UNDER 37 C.F.R. § 1.111

MAIL STOP AMENDMENTS
COMMISSIONER FOR PATENTS
P.O. BOX 1450
ALEXANDRIA, VIRGINIA 22313

Commissioner:

In response to the Non-Final Office Action dated March 19, 2020, please amend the above-identified application as follows.

If extensions of time are necessary to prevent abandonment of this application, then such extensions of time are hereby petitioned. Applicants do not believe that any fees are due at this time. If, however, any fees are required, including fees for extensions of time, then the Commissioner is authorized to charge such fees to Gardella Grace P.A. deposit account number 601484, referencing docket number 474139US02.

Amendments to the Claims begin on page **2** of this paper.

Remarks begin on page **2** of this paper.

AMENDMENTS TO THE CLAIMS

Please amend the claims as follows:

1. (Original) A method for automatically categorizing a condition of a characteristic of a property, the method comprising:
 - obtaining, by processing circuitry, an aerial image of a geographic region including the property;
 - extracting, by the processing circuitry, one or more features of a plurality of features from the aerial image, wherein
 - the one or more features are each represented by a set of pixel groupings, and
 - the one or more features represent the characteristic of the property, wherein
 - each pixel grouping of the set of pixel groupings comprises at least one of angles, outlines, or substantially homogenous pixel fields;
 - applying, by the processing circuitry, a first portion of the set of pixel groupings to a first machine learning classifier to determine a characteristic classification of the characteristic from a plurality of potential classifications of the characteristic, wherein
 - the first machine learning classifier is trained to identify at least a portion of the one or more features from the first portion of the set of pixel groupings; and
 - applying, by the processing circuitry, a second portion of the set of pixel groupings to a second machine learning classifier to determine a condition classification of the characteristic from a plurality of potential condition classifications of the characteristic, wherein

the second machine learning classifier is trained to identify, from the second portion of the set of pixel groupings, property characteristic conditions of the characteristic having the characteristic classification.

2. (Original) The method of claim 1, further comprising comparing, by the processing circuitry, the condition classification to a historic condition classification to identify a change in condition of the characteristic of the property.

3. (Original) The method of claim 1, further comprising preparing, by the processing circuitry for presentation to a user, a graphical report comprising condition information regarding the condition classification.

4. (Original) The method of claim 3, wherein the preparing comprises preparing the graphical report as an interactive user interface.

5. (Currently Amended) The method of claim 1, wherein at least one of the first machine learning classifier or the second machine learning classifier comprises a convolutional neural network (CNN) ~~CNN~~ model.

6. (Original) The method of claim 1, wherein the plurality of potential condition classifications comprises a numeric scale of condition classifications ranging between a needs replacement condition and a like new condition.

7. (Original) The method of claim 1, further comprising determining, by the processing circuitry based in part on the characteristic classification and the condition classification, a cost for repair or replacement of the characteristic of the property.

8. (Original) The method of claim 1, further comprising determining, by the processing circuitry based in part on the characteristic classification and the condition classification, a risk estimate of damage to the characteristic of the property due to one or more disasters.

9. (Currently Amended) A system for automatically categorizing a condition of a property feature of a property, the system comprising:

- a non-transitory computer readable storage region storing

- a first machine learning analysis model trained to identify one or more property characteristics, and

- a second machine learning analysis model trained to identify one or more property conditions;

- processing circuitry; and

- a non-transitory computer readable medium having instructions stored thereon;

- wherein the instructions, when executed by the processing circuitry, cause the processing circuitry to

- extract a set of image-related features from an aerial image, wherein the set of image-related features represent the property feature;

- apply [[the]] a first portion of the set of image-related features to the first machine

- learning analysis model to determine a characteristic classification of the property

feature from a plurality of potential characteristic classifications of the property feature; and
apply [[the]] a second portion of the image-related features to the second machine learning analysis model to determine a condition classification of the property feature from a plurality of potential condition classifications of the property feature, wherein

the second machine learning analysis model is trained to identify, from the second portion of the set of image-related features, property characteristic conditions of the property feature having the characteristic classification.

10. (Original) The system of claim 9, wherein each image-related feature of the set of image-related features comprises at least one of angles, outlines, or substantially homogenous pixel fields.

11. (Currently Amended) The system of claim 9, wherein the instructions, when executed by the processing circuitry, cause the processing circuitry to, prior to extracting the set of image-related features, assess orthogonality of the aerial image.

12. (Original) The system of claim 11, wherein the instructions, when executed by the processing circuitry, cause the processing circuitry to, responsive to assessing that the orthogonality of the aerial image does not correspond to a true orthophoto form, cause correction of the aerial image to the true orthophoto form.

13. (Original) The system of claim 9, wherein the instructions, when executed by the processing circuitry, cause the processing circuitry to obtain, via a network from a remote computing system, the aerial image of the geographic area.

14. (Currently Amended) The system of claim 13, wherein the instructions, when executed by the processing circuitry, cause the processing circuitry to, prior to obtaining the aerial image, determine, based at least in part on the property feature, a preferred image type corresponding to the ~~characteristic classification~~ property feature.

15. (Currently Amended) The system of claim 9, wherein the plurality of potential characteristic classifications comprises at least one of a plurality of potential sizes, a plurality of potential shapes, or a plurality of potential materials of the ~~characteristic of the~~ property feature.

16. (Currently Amended) A non-transitory computer readable medium having instructions stored thereon, wherein the instructions, when executed by processing circuitry, cause the processing circuitry to:

obtain aerial and/or terrestrial imagery including a property;

extract a plurality of pixel groupings from the aerial and/or terrestrial imagery, wherein

the plurality of pixel groupings includes a respective set of pixel groupings

representative of each feature of one or more features of the property, wherein

each pixel grouping of the set of pixel groupings comprises at least one of

angles, outlines, or substantially homogenous pixel fields; and

determine at least one characteristic and at least one condition of the property, wherein
determining comprises, for each feature of the one or more features of the property,
apply at least a portion of the one or more sets of pixel groupings corresponding to
the respective feature to one or more first machine learning classifiers trained to
identify one or more characteristics of the respective feature, and
apply at least a portion of the one or more sets of [[of]] pixel groupings corresponding
to the respective feature to one or more second machine learning classifiers
trained to identify a condition of the respective feature in view of at least a first
characteristic of the one or more characteristics.

17. (Currently Amended) The non-transitory computer readable medium of claim 16, further
comprising using the at least one characteristic and the at least one condition[[.]] to determine
one or more of a risk estimate, a repair estimate, [[and]] or a replacement estimate.

18. (Currently Amended) The non-transitory computer readable medium of claim 17, wherein
the instructions, when executed by the processing circuitry, cause the processing circuitry to
access one or more known property characteristics, wherein

determining the one or more of the damage risk estimate, the repair estimate, [[and]] or the
replacement estimate comprises applying, to the determining, the one or more known
property characteristics.

19. (Original) The non-transitory computer readable medium of claim 16, wherein the one or more characteristics of a first feature of the one or more features comprises a shape characteristic and a material characteristic.

20. (Original) The non-transitory computer readable medium of claim 16, wherein extracting the plurality of pixel groupings from the aerial and/or terrestrial imagery comprises extracting a first set of pixel groupings from an aerial image and a second set of pixel groupings from a terrestrial image.

21. (Original) The non-transitory computer readable medium of claim 16, wherein a first feature of the one or more features comprises a rooftop of a house, and a second feature of the one or more features comprises a structure adjacent to the house.

22. (Original) The non-transitory computer readable medium of claim 16, wherein the aerial and/or terrestrial imagery comprises a three-dimensional (3D) aerial image.

REMARKS

Status of the Claims

Claims 1-22 are currently pending. Claims 5, 9, 11, and 14-18 are currently amended.

The present amendments introduce no new matter.

Claim Objections

In the Non-Final Office Action of March 19, 2020 (“Office Action”), claim 5 was objected to for including an acronym. Claim 5 is hereby amended to spell out the acronym, as requested, rendering the rejection moot. Support for the amendment may be found at paragraph 45 of the specification as filed.

Double Patenting

In the Office Action, previously pending claims 1-20 were rejected on the ground of nonstatutory double patenting as being allegedly unpatentable over claims 1-20 of U.S. Patent No. 10,529,029. To advance prosecution and accelerate allowance, Applicant files herewith a terminal disclaimer, rendering the rejections moot.

Claim Amendments

Claims 9, 11, and 14-18 are hereby amended to correct minor typographical errors and antecedent basis issues. No new matter has been added.

No Disclaimers or Disavowals

Although this paper may amend the specification or claims, identify claimed features not taught or suggested in the prior art, or otherwise distinguish the claimed subject matter from the prior art, Applicant(s) are not conceding that the subject matter of any previously pending claim is not patentable over the prior art. Applicant(s) reserve the right to later pursue claims covering any of the subject matter embraced by the previously pending claims or supported by the specification and drawings as filed. Accordingly, the Office should not infer from this paper any disclaimer or disavowal of any subject matter.

CONCLUSION

In view of the above, it is believed that the claims, as amended, are in condition for allowance. Favorable reconsideration of this application is respectfully requested. Primary Examiner Nguyen is encouraged to contact Representative Natalie Grace at 703-740-4538 should any additional information be necessary to advance prosecution and accelerate allowance.

Respectfully submitted,

/Natalie J. Grace/

Natalie J. Grace
Attorney of Record
Registration No. 65,803

Ruth G. Davila
Agent of Record
Registration No. 73,956

Date: March 23, 2020

GARDELLA GRACE P.A.
80 M Street SE, 1st Floor
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Facsimile: (703) 740-4541

Electronic Acknowledgement Receipt

EFS ID:	38943764
Application Number:	16733888
International Application Number:	
Confirmation Number:	5317
Title of Invention:	Platform, Systems, and Methods for Identifying Property Characteristics and Property Feature Conditions Through Aerial Imagery Analysis
First Named Inventor/Applicant Name:	Takeshi Okazaki
Customer Number:	146018
Filer:	Natalie J. Grace/Jon Bhatt
Filer Authorized By:	Natalie J. Grace
Attorney Docket Number:	474139US02
Receipt Date:	23-MAR-2020
Filing Date:	03-JAN-2020
Time Stamp:	17:35:06
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment		no			
File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		474139US02_Response.pdf	157269	yes	11
			8338579b18914636ae278238c807704050a912b3		

Multipart Description/PDF files in .zip description			
Document Description		Start	End
Amendment/Req. Reconsideration-After Non-Final Reject		1	1
Claims		2	8
Applicant Arguments/Remarks Made in an Amendment		9	11
Warnings:			
Information:			
Total Files Size (in bytes):		157269	
<p>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.</p> <p><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.</p> <p><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.</p> <p><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.</p>			



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NOTICE OF ALLOWANCE AND FEE(S) DUE

146018 7590 04/03/2020
Gardella Grace P.A.
80 M Street SE, 1st Floor
Washington, DC 20003

EXAMINER

NGUYEN, TIEN C

ART UNIT

PAPER NUMBER

3694

DATE MAILED: 04/03/2020

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/733,888	01/03/2020	Takeshi Okazaki	474139US02	5317

TITLE OF INVENTION: Platform, Systems, and Methods for Identifying Property Characteristics and Property Feature Conditions Through Aerial Imagery Analysis

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	07/06/2020

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

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

HOW TO REPLY TO THIS NOTICE:

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

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

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

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

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

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

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

PART B - FEE(S) TRANSMITTAL

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

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

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

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

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

146018 7590 04/03/2020
Gardella Grace P.A.
80 M Street SE, 1st Floor
Washington, DC 20003

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

Certificate of Mailing or Transmission

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

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/733,888	01/03/2020	Takeshi Okazaki	474139US02	5317

TITLE OF INVENTION: Platform, Systems, and Methods for Identifying Property Characteristics and Property Feature Conditions Through Aerial Imagery Analysis

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	07/06/2020

EXAMINER	ART UNIT	CLASS-SUBCLASS
NGUYEN, TIEN C	3694	705-004000

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.
16/733,888	01/03/2020	Takeshi Okazaki	474139US02	5317
146018	7590	04/03/2020	EXAMINER	
Gardella Grace P.A.			NGUYEN, TIEN C	
80 M Street SE, 1st Floor			ART UNIT	
Washington, DC 20003			PAPER NUMBER	

3694

DATE MAILED: 04/03/2020

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

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

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

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

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

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

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

Privacy Act Statement

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

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

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

Notice of Allowability	Application No. 16/733,888	Applicant(s) Okazaki, Takeshi	
	Examiner TIEN C NGUYEN	Art Unit 3694	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 3/23/2020.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on ____.

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

3. ☒ The allowed claim(s) is/are 1-22. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

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

Certified copies:

a) ☐ All b) ☐ Some *c) ☐ None of the:

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

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

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

* Certified copies not received: ____.

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

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

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

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

Attachment(s)

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

/TIEN C NGUYEN/ Primary Examiner, Art Unit 3694	
--	--

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.

Examiner's Statement of Reasons for Allowance

1. The following an Allowance in response filed on 3/23/2019.
2. Claims 5, 9, 11 and 14-18 are currently amended.
3. Therefore, claims 1-22 are pending and allowed below.

Reasons for Allowance

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

Regarding the 35 USC 101 in view of Alice rejections, Applicant's claims recite the additional limitations of "obtaining, by processing circuitry, an aerial image of a geographic region including the property; extracting, by the processing circuitry, one or more features of a plurality of features from the aerial image, wherein the one or more features are each represented by a set of pixel groupings, and the one or more features represent the characteristic of the property, wherein each pixel grouping of the set of pixel groupings comprises at least one of angles, outlines, or substantially homogenous pixel fields; applying, by the processing circuitry, a first portion of the set of pixel groupings to a first machine learning classifier to determine a characteristic classification of the characteristic from a plurality of potential classifications of the characteristic, wherein the first machine learning classifier is trained to identify at least a portion of the one or more features from the first portion of the set of pixel groupings; and applying, by the processing circuitry, a second portion of the set of pixel groupings to a second machine learning classifier to determine a condition classification of the characteristic from a plurality of potential condition classifications of the characteristic, wherein the second machine learning classifier is trained to identify, from the second portion of the set of pixel groupings, property characteristic conditions of the characteristic having the characteristic classification", when viewed as an ordered

combination, these additional limitations of the claims are significantly more than categorizing a condition of a characteristic of a property. Thus, the claims are patent eligible.

Regarding the 35 USC 103 rejections, Swanson et al. (8,775,219) teaches a method and a system relates to using remote sensing capabilities like hyperspectral imaging to identify roof characteristics for insurance purposes. Downey et al. (2015/0325064) teaches methods, systems, and apparatus, including computer programs encoded on computer storage media, for unmanned aerial vehicle authorization and geofence envelope determination. Cuttell et al. (2015/0310558) teaches a computer implemented method for linking an underwriting action to a customer is presented. The method receives an inspection model corresponding to a geographic location associated with a structure and determines that a virtual inspection is necessary based on the inspection model. The method also retrieves a first aerial image corresponding to the geographic location and a second aerial image corresponding to the geographic location and a time threshold. The method further receives a comparison data value corresponding to the first and second aerial image, determines an underwriting action based on the comparison data and links the underwriting action to a customer account. Swanson, Downey and Cuttell does not teach a method and a system for automatically categorizing a repair condition of a property characteristic, comprising: "obtaining, by processing circuitry, an aerial image of a geographic region including the property; extracting, by the processing circuitry, one or more features of a plurality of features from the aerial image, wherein the one or more features are each represented by a set of pixel groupings, and the one or more features represent the characteristic of the property, wherein each pixel grouping of the set of pixel groupings comprises at least one of angles, outlines, or substantially homogenous pixel fields; applying, by the processing circuitry, a first portion of the set of pixel groupings to a first machine learning classifier to determine a characteristic classification of the characteristic from a plurality of potential classifications of the characteristic, wherein the first machine learning classifier is trained to identify at least a portion of the one or more features

from the first portion of the set of pixel groupings; and applying, by the processing circuitry, a second portion of the set of pixel groupings to a second machine learning classifier to determine a condition classification of the characteristic from a plurality of potential condition classifications of the characteristic, wherein the second machine learning classifier is trained to identify, from the second portion of the set of pixel groupings, property characteristic conditions of the characteristic having the characteristic classification”.

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

Conclusion

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to TIEN C. NGUYEN whose telephone number is 571-270-5108. The examiner can normally be reached on Monday-Friday (6am-2pm EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, Ben Sigmond can be reached on 303-297-4411. The fax phone number for the organization where this application or proceeding is assigned is 571-270-6108.

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.

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or faxed to 571-273-8300.

Hand delivered responses should be brought to the United States Patent and Trademark
Office Customer Service Window:

Randolph Building 401 Dulany Street Alexandria, VA 22314.

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/TIEN C NGUYEN/
Primary Examiner, Art Unit 3694

Notice of References Cited	Application/Control No. 16/733,888		Applicant(s)/Patent Under Reexamination Okazaki, Takeshi	
	Examiner TIEN C NGUYEN		Art Unit 3694	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-8775219-B2	07-2014	Swanson; Aaron L.	G06Q50/16	705/4
*	B	US-20150325064-A1	11-2015	Downey; Jonathan	G08G5/0026	701/29.3
*	C	US-20150310558-A1	10-2015	Cuttell; Matthew	G06Q40/08	705/4
*	D	US-6732120-B1	05-2004	Du; Mike	G01C21/20	715/764
*	E	6732120	07-2014	Swanson; Aaron L.	G06Q50/16	705/4
*	F	US-20090265193-A1	10-2009	COLLINS; Dean	G06Q30/0185	705/4
*	G	20150310557	11-2015	Downey; Jonathan	G08G5/0026	701/29.3
*	H	US-9846915-B2	12-2017	Howe; Richard L.	G06Q40/08	1/1
*	I	US-20160086285-A1	03-2016	Jordan Peters; Julie A.	G06Q40/08	705/4
*	J	US-20130226667-A1	08-2013	Terrazas; Alex	G06Q30/0205	705/7.34
*	K	US-20050063563-A1	03-2005	Soliman, Samir S.	H04N1/00204	382/104
*	L	US-8731234-B1	05-2014	Ciarcia; Christopher Albert	G06K9/00637	382/100
*	M	US-20140032433-A1	01-2014	Eick; Stephen G.	G06Q50/163	705/314

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	P					
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NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	Systems and Methods for Insurers to Monitor Continuously Structural Status of Insured Homes, IP.com Number: IPCOM000177511D, December 16, 2008. (Year: 2008).
	V	Recognizing picture-taking environment from satellite images: A feasibility study; 2008 19th International Conference on Pattern Recognition (Page(s): 1-4); J. Luo, W. Hao, D. McIntyre, 1-Dec-2008. (Year: 2008).
	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. 16/733,888	Applicant(s)/Patent Under Reexamination Okazaki, Takeshi	
	Examiner TIEN C NGUYEN	Art Unit 3694	Page 2 of 2

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*	B	US-8346578-B1	01-2013	Hopkins, III; John Chandler	G06Q40/00	382/100
*	C	US-20100179787-A2	07-2010	Pershing; Chris	G06Q50/16	702/156
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Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

<i>Index of Claims</i> 	Application/Control No. 16/733,888	Applicant(s)/Patent Under Reexamination Okazaki, Takeshi
	Examiner TIEN C NGUYEN	Art Unit 3694

✓	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										
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<i>Search Notes</i> 	Application/Control No. 16/733,888	Applicant(s)/Patent Under Reexamination Okazaki, Takeshi
	Examiner TIEN C NGUYEN	Art Unit 3694

CPC - Searched*		
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G06Q	03/16/2020	/tn/

CPC Combination Sets - Searched*		
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G 06Q 40/08, G 06Q 40/02, G 06Q 10/10, G 06F19/328, G 06Q 30/02.	03/16/2020	/tn/

US Classification - Searched*			
Class	Subclass	Date	Examiner
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705	39	03/28/2020	/tn/
705	37	03/28/2020	/tn/
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705	40	03/28/2020	/tn/
235	375	03/28/2020	/tn/
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235	386	03/28/2020	/tn/
707	734	03/28/2020	/tn/
705	27.2	03/28/2020	/tn/

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

/TIEN C NGUYEN/ Primary Examiner, Art Unit 3694	
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<i>Search Notes</i> 	Application/Control No. 16/733,888	Applicant(s)/Patent Under Reexamination Okazaki, Takeshi
	Examiner TIEN C NGUYEN	Art Unit 3694

Search Notes		
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Inventor search.	03/28/2020	/tn/
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Interference Search			
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/TIEN C NGUYEN/ Primary Examiner, Art Unit 3694	
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Issue Classification 	Application/Control No. 16/733,888	Applicant(s)/Patent Under Reexamination Okazaki, Takeshi
	Examiner TIEN C NGUYEN	Art Unit 3694

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/TIEN C NGUYEN/ Primary Examiner, Art Unit 3694	28 March 2020	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	1

Issue Classification 	Application/Control No. 16/733,888	Applicant(s)/Patent Under Reexamination Okazaki, Takeshi
	Examiner TIEN C NGUYEN	Art Unit 3694

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Issue Classification 	Application/Control No. 16/733,888	Applicant(s)/Patent Under Reexamination Okazaki, Takeshi
	Examiner TIEN C NGUYEN	Art Unit 3694

☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☒ T.D. ☐ R.1.47															
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CONFIRMATION NO. 5317

SERIAL NUMBER 16/733,888	FILING or 371(c) DATE 01/03/2020 RULE	CLASS 705	GROUP ART UNIT 3694	ATTORNEY DOCKET NO. 474139US02		
APPLICANTS Aon Benfield Inc., Chicago, IL INVENTORS Takeshi Okazaki, Tokyo, JAPAN; ** CONTINUING DATA ***** This application is a CIP of 15/714,376 09/25/2017 PAT 10529029 which claims benefit of 62/398,665 09/23/2016 ** FOREIGN APPLICATIONS ***** ** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** 01/24/2020						
Foreign Priority claimed ☐ Yes ☒ No 35 USC 119(a-d) conditions met ☐ Yes ☒ No Verified and Acknowledged <u>/TIEN C. NGUYEN/</u> Examiner's Signature		☐ Met after Allowance Initials	STATE OR COUNTRY JAPAN	SHEETS DRAWINGS 15	TOTAL CLAIMS 22	INDEPENDENT CLAIMS 3
ADDRESS Gardella Grace P.A. 80 M Street SE, 1st Floor Washington, DC 20003 UNITED STATES						
TITLE Platform, Systems, and Methods for Identifying Property Characteristics and Property Feature Conditions Through Aerial Imagery Analysis						
FILING FEE RECEIVED 1920	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:			☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit		

EAST Search History

EAST Search History (Prior Art)

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EAST Search History

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S3	7105	S1 and S2	USPAT	OR	ON	2020/03/28 05:29
S4	8039	aerial\$3 near7 imag\$3	USPAT	OR	ON	2020/03/28 05:29
S5	46894	(geographic\$3) near7 (region\$3 or boundar\$3)	USPAT	OR	ON	2020/03/28 05:30
S6	791	S4 and S5	USPAT	OR	ON	2020/03/28 05:30
S7	30	S3 and S6	USPAT	OR	ON	2020/03/28 05:30
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S11	106	(property or properties or house or houses or "real property" or resident\$3) near7 (damag\$3) with disaster\$3	USPAT	OR	ON	2020/03/28 05:33
S12	4	S11 and S3	USPAT	OR	ON	2020/03/28 05:33
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S15	10	S11 and S4	USPAT	OR	ON	2020/03/28 05:35
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S24	41745	pixel\$3 near7 (group\$3 or grouping\$3)	USPAT	OR	ON	2020/03/28 10:33
S25	54	S23 and S24	USPAT	OR	ON	2020/03/28 10:33
S26	6016	(property or properties or house or houses or	USPAT	OR	ON	2020/03/28

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		"real property" or resident\$3) near7 (classif\$3)				10:34
S27	1	S25 and S26	USPAT	OR	ON	2020/03/28 10:34
S28	47173	(risk\$3 or damag\$3) near7 (estimat\$3 or determin\$3)	USPAT	OR	ON	2020/03/28 10:35
S29	1	S27 and S28	USPAT	OR	ON	2020/03/28 10:35
S30	40	("20050251427" "20060095304" "20080103841" "20090063234" "20090265193" "20090276708" "20100179787" "20100215212" "20100257477" "20130117078" "20130297353" "20140032433" "20140039935" "20140149144" "20150332355" "20160086285" "6098070" "6219930" "7676061" "8078875" "8170840" "8209152" "8346578" "8401222" "8401877" "8515125" "8670961" "8731234" "8756085" "8774525" "8775219" "8818572" "8818770" "8825454" "8874454" "8929586" "8977520" "8995757" "9002719").PN. OR ("9846915").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2020/03/28 10:38
S31	51	("2623291" "2623292" "3029522" "3890715" "4131998" "4353988" "4389782" "4435769" "4507872" "4517748" "4896428" "5128859" "5293309" "5317503" "5377098" "5491902").PN. OR ("6219930").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2020/03/28 10:39
S32	17	("20020154574" "20040016159" "20040073434" "2431827" "3111736" "3456373" "6219930" "6775935").PN. OR ("7331133").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2020/03/28 10:40
S33	127	("20010041993" "20020055861" "20020072975" "20020120475" "20020133721" "20020158968" "20020161533" "20030028296" "20030112263" "20030120519" "20030154111" "20030233261" "20040039577" "20040044549" "20040103010" "20040128155" "20040133317" "20040186744" "20050046597" "20050083413" "20050108065" "20050125117" "20050131596" "20050146604" "20050251427" "20060114531" "20060132291" "20060155616" "20060200307" "20070061109" "20070100669" "20070247331" "20070250232" "20080046261" "20080189142" "20080222005" "20080267487" "20080281658"	US-PGPUB; USPAT; USOCR	OR	ON	2020/03/28 10:40

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S34	125	("2002/0133721").URPN.	USPAT	OR	ON	2020/03/28 10:40
S35	71	("20010032192" "20020120846" "20020133721" "20030074471" "20030187783" "20040039686" "20040111305" "20050039036" "20050043961" "20050084083" "20050091524" "20050160280" "20050190905" "20050278550" "20060149674" "20060236395" "20070084912" "20070106582" "20070112667" "20070203732" "20080040275" "20080109392" "20080172316" "20080203170" "20080253645" "20080283596" "20090012896" "20090099959"	US-PGPUB; USPAT; USOCR	OR	ON	2020/03/28 10:40

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		"20090132347" "20090210444" "20100005013" "20100076890" "20100094791" "20100106611" "20100145836" "20100169163" "20100191661" "20100223164" "20100228656" "20110022483" "20110173116" "20120101927" "5627886" "6330546" "6598030" "6636833" "6658393" "6839682" "7058597" "7089592" "7246740" "7263506" "7313545" "7562814" "7603331" "7761379" "7793835" "7925607" "7984500" "7991689" "8020763").PN. OR ("8458069").URPN.				
S36	427	("5335265" "5335278" "5345595" "5351290").PN. OR ("5627886").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2020/03/28 10:41
S37	622	("5032979" "5517519" "5579222" "5590245" "5614940" "5619656" "5627886" "5678041" "5696965" "5706507" "5727159" "5796952").PN. OR ("6018619").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2020/03/28 10:41
S38	8	("20140316614" "20150371543" "20160012730" "20160224932" "20160292696" "20170011340" "20170011343" "20170148467").PN. OR ("10102758").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2020/03/28 10:42
S39	8348	aerial\$3 near7 imag\$3	USPAT	OR	ON	2020/03/28 10:42
S40	49314	(geographic\$3) near7 (region\$3 or boundar\$3)	USPAT	OR	ON	2020/03/28 10:42
S41	849	S39 and S40	USPAT	OR	ON	2020/03/28 10:42
S42	6	("20060122776" "20070025595" "20130226667" "20190050625" "20190130641" "9389084").PN. OR ("10339646").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2020/03/28 10:57
S43	7	("20060239537" "20130141540" "20150169723").PN. OR ("9389084").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2020/03/28 10:57
S44	6	("20060122776" "20070025595" "20130226667" "20190050625" "20190130641" "9389084").PN. OR ("10339646").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2020/03/28 10:57
S45	10	("2013/0226667").URPN.	USPAT	OR	ON	2020/03/28 10:57
S46	849	S39 and S40	USPAT	OR	ON	2020/03/28 10:58
S47	12	("20040239688" "20050063563" "20060267803" "20120038633" "20150317597" "20160300375" "20160366546" "20170371897" "7248285" "7590259" "9652681" "9939813").PN. OR	US-PGPUB; USPAT; USOCR	OR	ON	2020/03/28 10:58

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		("10290137").URPN.				
S48	10	("2012/0038633").URPN.	USPAT	OR	ON	2020/03/28 10:58
S49	12	("20040239688" "20050063563" "20060267803" "20120038633" "20150317597" "20160300375" "20160366546" "20170371897" "7248285" "7590259" "9652681" "9939813").PN. OR ("10290137").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2020/03/28 10:59
S50	10	("2012/0038633").URPN.	USPAT	OR	ON	2020/03/28 10:59
S53	11	("2012/0038633").URPN.	USPAT	OR	ON	2020/03/28 06:32
S54	492	(extract\$3) with ((aerial\$3) near7 (imag\$3))	USPAT	OR	ON	2020/03/28 06:33
S55	44236	pixel\$3 near7 (group\$3 or grouping\$3)	USPAT	OR	ON	2020/03/28 06:33
S56	59	S54 and S55	USPAT	OR	ON	2020/03/28 06:33
S57	95	("20020154174" "20030014224" "20030028393" "20030115163" "20030147553" "20030171957" "20030233310" "20040047498" "20040105090" "20040105573" "20040220906" "20050201618" "20050203768" "20050288959" "20060133699" "20060137736" "20060200311" "20060232605" "20060262112" "20060265287" "20070150366" "20070179757" "20070291994" "20080021683" "20080105045" "20080123994" "20080204570" "20080221843" "20080231700" "20080262789" "20080273753" "20080310756" "20090096884" "20090097744" "20090132210" "20090132436" "20090141020" "20090304227" "20100034483" "20100110074" "20100114537" "20100296693" "20110096083" "20110187713" "5247356" "5633995" "6323885" "6333749" "6385541" "6396491" "6446053" "6496184" "6636803" "6836270" "6980690" "7003400" "7006977" "7133551" "7305983" "7324666" "7343268" "7424133" "7787659" "7873238" "7991226" "7995799" "8068643" "8078436" "8233666").PN. OR ("8731234").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2020/03/28 06:33
S58	63	("20010025229" "20010032062" "20010047250" "20020087389" "20020099725" "20020116163"	US-PGPUB; USPAT; USOCR	OR	ON	2020/03/28 06:33

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EAST Search History

		"20020120554" "20030028393" "20030171957" "20040054568" "20040186763" "20040193474" "20050071376" "20050081161" "20050187778" "20060155571" "20070027564" "20070061774" "20070073610" "20080103908" "20080255914" "20080262789" "20090006185" "20090132436" "20090174768" "20090265193" "20100110074" "20100161495" "20100211421" "20120016773" "20120101783" "20130046672" "20130211790" "20140012720" "20140095122" "20140214473" "20140222608" "20140229212" "20140257924" "20140278809" "20140279692" "20150186953" "4964060" "5189606" "5668736" "5761674" "5893082" "5918219" "6446053" "6996503" "7254553" "7283975" "7752065" "7783523" "7844503" "8001160" "8065123" "8510196" "8706646" "8712893" "8731234" "8923551").PN. OR ("10332138").URPN.				
S59	34	("2014/0095122").URPN.	USPAT	OR	ON	2020/03/28 06:33
L1	11	("2012/0038633").URPN.	USPAT	OR	ON	2020/03/28 06:32
L2	492	(extract\$3) with ((aerial\$3) near7 (imag\$3))	USPAT	OR	ON	2020/03/28 06:33
L3	44236	pixel\$3 near7 (group\$3 or grouping\$3)	USPAT	OR	ON	2020/03/28 06:33
L4	59	L2 and L3	USPAT	OR	ON	2020/03/28 06:33

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L5	95	("20020154174" "20030014224" "20030028393" "20030115163" "20030147553" "20030171957" "20030233310" "20040047498" "20040105090" "20040105573" "20040220906" "20050201618" "20050203768" "20050288959" "20060133699" "20060137736" "20060200311" "20060232605" "20060262112" "20060265287" "20070150366" "20070179757" "20070291994" "20080021683" "20080105045" "20080123994" "20080204570" "20080221843" "20080231700" "20080262789" "20080273753" "20080310756" "20090096884" "20090097744" "20090132210" "20090132436" "20090141020" "20090304227" "20100034483" "20100110074" "20100114537" "20100296693" "20110096083" "20110187713" "5247356" "5633995" "6323885" "6333749" "6385541" "6396491" "6446053" "6496184" "6636803" "6836270" "6980690" "7003400" "7006977" "7133551" "7305983" "7324666" "7343268" "7424133" "7787659" "7873238" "7991226" "7995799" "8068643" "8078436" "8233666").PN. OR ("8731234").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2020/03/28 06:33
L6	63	("20010025229" "20010032062" "20010047250" "20020087389" "20020099725" "20020116163" "20020120554" "20030028393" "20030171957" "20040054568" "20040186763" "20040193474" "20050071376" "20050081161" "20050187778" "20060155571" "20070027564" "20070061774" "20070073610" "20080103908"	US-PGPUB; USPAT; USOCR	OR	ON	2020/03/28 06:33

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EAST Search History

		"20080255914" "20080262789" "20090006185" "20090132436" "20090174768" "20090265193" "20100110074" "20100161495" "20100211421" "20120016773" "20120101783" "20130046672" "20130211790" "20140012720" "20140095122" "20140214473" "20140222608" "20140229212" "20140257924" "20140278809" "20140279692" "20150186953" "4964060" "5189606" "5668736" "5761674" "5893082" "5918219" "6446053" "6996503" "7254553" "7283975" "7752065" "7783523" "7844503" "8001160" "8065123" "8510196" "8706646" "8712893" "8731234" "8923551").PN. OR ("10332138").URPN.				
L7	34	("2014/0095122").URPN.	USPAT	OR	ON	2020/03/28 06:33
S1	399871	receiv\$3 near7 request\$3	USPAT	OR	ON	2020/03/28 05:27
S2	142259	(property or properties or house or houses or "real property" or resident\$3) near7 (characteristic\$3 or identification\$3)	USPAT	OR	ON	2020/03/28 05:29
S3	7105	S1 and S2	USPAT	OR	ON	2020/03/28 05:29
S4	8039	aerial\$3 near7 imag\$3	USPAT	OR	ON	2020/03/28 05:29
S5	46894	(geographic\$3) near7 (region\$3 or boundar\$3)	USPAT	OR	ON	2020/03/28 05:30
S6	791	S4 and S5	USPAT	OR	ON	2020/03/28 05:30
S7	30	S3 and S6	USPAT	OR	ON	2020/03/28 05:30
S8	4	("5519809" "5559707" "5966135" "6732120").PN. OR ("9760649").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2020/03/28 05:31
S9	134	("5193185" "5214757" "5418906" "5426780" "5751612" "5953722" "5963956" "5968109" "5974419" "6047280" "6282489").PN. OR ("6732120").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2020/03/28 05:32
S10	26181	(property or properties or house or houses or "real property" or resident\$3) near7 (damag\$3)	USPAT	OR	ON	2020/03/28 05:33
S11	106	(property or properties or house or houses or "real property" or resident\$3) near7 (damag\$3) with disaster\$3	USPAT	OR	ON	2020/03/28 05:33
S12	4	S11 and S3	USPAT	OR	ON	2020/03/28 05:33
S13	2	("20180089763").PN.	US-PGPUB;	OR	ON	2020/03/28

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			USPAT; USOCR; DERWENT			05:34
S14	0	("2018/0089763").URPN.	USPAT	OR	ON	2020/03/28 05:35
S15	10	S11 and S4	USPAT	OR	ON	2020/03/28 05:35
S16	13	("20080262789" "20090265193" "20090326383" "7317416" "7944559" "8346578").PN. OR ("8775219").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2020/03/28 05:36
S17	174	("2009/0265193").URPN.	USPAT	OR	ON	2020/03/28 05:37
S18	80	("20080059068" "20090265193" "20100012776" "20100215212" "20100228418" "20100286859" "20110270470" "20120197461" "20120250010" "20120271461" "20130206915" "20130216089" "20130238168" "20140061376" "20140259549" "20140267627" "20140277842" "20140316614" "20140316616" "20140336928" "20150325064" "20150343644" "20150344136" "20150377405" "20160004795" "20160176542" "4818990" "5575438" "7400384" "7496226" "7872794" "7929125" "8060270" "8207484" "8212995" "8346578" "8818572" "8830485" "8872818" "8874283" "8896819" "8997362" "9009000" "9129355" "9152863" "9162753" "9256225" "9256994" "9273981").PN. OR ("9513635").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2020/03/28 05:37
S19	16	("2015/0325064").URPN.	USPAT	OR	ON	2020/03/28 05:39
S20	49	("20020109829" "20030137645" "5345304" "6865034").PN. OR ("7400384").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2020/03/28 05:40
S21	80	("20080059068" "20090265193" "20100012776" "20100215212" "20100228418" "20100268409" "20100286859" "20110270470" "20120170797" "20120197461" "20120250010" "20120271461" "20130206915" "20130216089" "20130238168" "20140061376" "20140259549" "20140267627" "20140277842" "20140316614" "20140316616" "20140324405" "20140336928" "20150325064" "20150343644" "20150344136" "20150377405" "20160004795" "20160176542" "4818990" "5575438"	US-PGPUB; USPAT; USOCR	OR	ON	2020/03/28 05:40

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S22	8	"8775219"	USPAT	OR	ON	2020/03/28 06:19
S23	449	(extract\$3) with ((aerial\$3) near7 (imag\$3))	USPAT	OR	ON	2020/03/28 10:32
S24	41745	pixel\$3 near7 (group\$3 or grouping\$3)	USPAT	OR	ON	2020/03/28 10:33
S25	54	S23 and S24	USPAT	OR	ON	2020/03/28 10:33
S26	6016	(property or properties or house or houses or "real property" or resident\$3) near7 (classif\$3)	USPAT	OR	ON	2020/03/28 10:34
S27	1	S25 and S26	USPAT	OR	ON	2020/03/28 10:34
S28	47173	(risk\$3 or damag\$3) near7 (estimat\$3 or determin\$3)	USPAT	OR	ON	2020/03/28 10:35
S29	1	S27 and S28	USPAT	OR	ON	2020/03/28 10:35
S30	40	("20050251427" "20060095304" "20080103841" "20090063234" "20090265193" "20090276708" "20100179787" "20100215212" "20100257477" "20130117078" "20130297353" "20140032433" "20140039935" "20140149144" "20150332355" "20160086285" "6098070" "6219930" "7676061" "8078875" "8170840" "8209152" "8346578" "8401222" "8401877" "8515125" "8670961" "8731234" "8756085" "8774525" "8775219" "8818572" "8818770" "8825454" "8874454" "8929586" "8977520" "8995757" "9002719").PN. OR ("9846915").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2020/03/28 10:38
S31	51	("2623291" "2623292" "3029522" "3890715" "4131998" "4353988" "4389782" "4435769" "4507872" "4517748" "4896428" "5128859" "5293309" "5317503" "5377098" "5491902").PN. OR ("6219930").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2020/03/28 10:39
S32	17	("20020154574" "20040016159" "20040073434" "2431827" "3111736" "3456373" "6219930" "6775935").PN. OR	US-PGPUB; USPAT; USOCR	OR	ON	2020/03/28 10:40

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03/28/2020 7:34:30 AM

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EAST Search History

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S36	427	("5335265" "5335278" "5345595" "5351290").PN. OR ("5627886").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2020/03/28 10:41
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S41	849	S39 and S40	USPAT	OR	ON	2020/03/28 10:42

03/28/2020 7:34:30 AM

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EAST Search History

EAST Search History (Interference)

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S3	44236	pixeS\$3 near7 (group\$3 or grouping\$3)	USPAT	OR	ON	2020/03/28 06:33
S4	59	S2 and S3	USPAT	OR	ON	2020/03/28 06:33
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S3	7105	S1 and S2	USPAT	OR	ON	2020/03/28 05:29
S4	8039	aerial\$3 near7 imag\$3	USPAT	OR	ON	2020/03/28 05:29
S5	46894	(geographic\$3) near7 (region\$3 or boundar\$3)	USPAT	OR	ON	2020/03/28 05:30
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3/28/2020 9:57:17 AM

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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)

146018 7590 04/03/2020
Gardella Grace P.A.
80 M Street SE, 1st Floor
Washington, DC 20003

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

Certificate of Mailing or Transmission

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

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/733,888	01/03/2020	Takeshi Okazaki	474139US02	5317

TITLE OF INVENTION: Platform, Systems, and Methods for Identifying Property Characteristics and Property Feature Conditions Through Aerial Imagery Analysis

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	07/06/2020

EXAMINER	ART UNIT	CLASS-SUBCLASS
NGUYEN, TIEN C	3694	705-004000

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 Gardella Grace P.A.

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

Aon Benfield Inc.

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

Chicago, IL

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. 601484

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 /Natalie J. Grace/

Date April 7, 2020

Typed or printed name Natalie J. Grace

Registration No. 65803

Electronic Patent Application Fee Transmittal				
Application Number:		16733888		
Filing Date:		03-Jan-2020		
Title of Invention:		Platform, Systems, and Methods for Identifying Property Characteristics and Property Feature Conditions Through Aerial Imagery Analysis		
First Named Inventor/Applicant Name:		Takeshi Okazaki		
Filer:		Natalie J. Grace/Anthony Gorney		
Attorney Docket Number:		474139US02		
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:				
UTILITY APPL ISSUE FEE	1501	1	1000	1000

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				1000

Electronic Acknowledgement Receipt	
EFS ID:	39084167
Application Number:	16733888
International Application Number:	
Confirmation Number:	5317
Title of Invention:	Platform, Systems, and Methods for Identifying Property Characteristics and Property Feature Conditions Through Aerial Imagery Analysis
First Named Inventor/Applicant Name:	Takeshi Okazaki
Customer Number:	146018
Filer:	Natalie J. Grace/Anthony Gorney
Filer Authorized By:	Natalie J. Grace
Attorney Docket Number:	474139US02
Receipt Date:	07-APR-2020
Filing Date:	03-JAN-2020
Time Stamp:	13:43:23
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$1000
RAM confirmation Number	E202047D44541934
Deposit Account	601484
Authorized User	Anthony Gorney
<p>The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:</p> <p>37 CFR 1.16 (National application filing, search, and examination fees)</p> <p>37 CFR 1.17 (Patent application and reexamination processing fees)</p>	

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)	474139US02_IssueFeeTransmittal.pdf	115308	no	1
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Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	30473	no	2
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Warnings:

Information:

Total Files Size (in bytes):	145781
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New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Doc code: IDS

Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (02-18)

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

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

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	16/733888
	Filing Date	2020-01-03
	First Named Inventor	Takeshi Okazaki
	Art Unit	3694
	Examiner Name	Tien Nguyen
	Attorney Docket Number	474139US02

U.S.PATENTS							Remove
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear	
	1	10311302		2019-06-04	Kottenstette et al.		
	2	9141872		2015-09-22	Marchisio et al.		
	3	9569690		2017-02-14	Marchisio et al.		
	4	9858645		2018-01-02	Malitz		
	5	9031325		2015-05-12	Ouzounis		
	6	8682079		2014-03-25	Ouzounis		
	7	9589210		2017-03-07	Estrada et al.		
	8	10013774		2019-07-03 07/2018	Estrada et al.		

Change(s) applied to document,

/M.H.E./

4/9/2020

EFS Web 2.1.18

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /T.C.N/

Change(s) applied to document, M.H.E. 4/9/2020	Application/Control No. 16/733,888	Applicant(s)/Patent Under Reexamination Okazaki, Takeshi	
	Examiner TIEN C NGUYEN	Art Unit 3694	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-8775219-B2	07-2014	Swanson; Aaron L.	G06Q50/16	705/4
*	B	US-20150325064-A1	11-2015	Downey; Jonathan	G08G5/0026	701/29.3
*	C	US-20150310558-A1	10-2015	Cuttell; Matthew	G06Q40/08	705/4
*	D	US-6732120-B1	05-2004	Du; Mike	G01C21/20	715/764
*	E	6732120 05/2004	07-2014	Swanson; Aaron L. Du	G06Q50/16	705/4
*	F	US-20090265193-A1	10-2009	COLLINS; Dean	G06Q30/0185	705/4
*	G	20150310557 10/2015	11-2015	Downey; Jonathan Engelhorn	G08G5/0026	701/29.3
*	H	US-9846915-B2	12-2017	Howe; Richard L.	G06Q40/08	1/1
*	I	US-20160086285-A1	03-2016	Jordan Peters; Julie A.	G06Q40/08	705/4
*	J	US-20130226667-A1	08-2013	Terrazas; Alex	G06Q30/0205	705/7.34
*	K	US-20050063563-A1	03-2005	Soliman, Samir S.	H04N1/00204	382/104
*	L	US-8731234-B1	05-2014	Ciarcia; Christopher Albert	G06K9/00637	382/100
*	M	US-20140032433-A1	01-2014	Eick; Stephen G.	G06Q50/163	705/314

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	Systems and Methods for Insurers to Monitor Continuously Structural Status of Insured Homes, IP.com Number: IPCOM000177511D, December 16, 2008. (Year: 2008).
	V	Recognizing picture-taking environment from satellite images: A feasibility study; 2008 19th International Conference on Pattern Recognition (Page(s): 1-4); J. Luo, W. Hao, D. McIntyre, 1-Dec-2008. (Year: 2008).
	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.



UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/733,888	05/12/2020	10650285	474139US02	5317

146018 7590 04/22/2020
Gardella Grace P.A.
80 M Street SE, 1st Floor
Washington, DC 20003

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):

Takeshi Okazaki, Tokyo, JAPAN;
Aon Benfield Inc., Chicago, IL

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



UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/733,888	01/03/2020	Takeshi Okazaki	474139US02

CONFIRMATION NO. 5317

PUBLICATION NOTICE



OC000000116830728

146018
Gardella Grace P.A.
80 M Street SE, 1st Floor
Washington, DC 20003

Title:Platform, Systems, and Methods for Identifying Property Characteristics and Property Feature Conditions Through Aerial Imagery Analysis

Publication No.US-2020-0143212-A1

Publication Date:05/07/2020

NOTICE OF PUBLICATION OF APPLICATION

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

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

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

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

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

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

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE APPLICATION OF:	
AON BENFIELD INC.	EXAMINER: TIEN C. NGUYEN
U.S. PATENT NO.: 10,650,285	GROUP ART UNIT: 3694
ISSUED: MAY 12, 2020	DOCKET NO.: 474139US02
FOR: PLATFORM, SYSTEMS, AND METHODS FOR IDENTIFYING PROPERTY CHARACTERISTICS AND PROPERTY FEATURE CONDITIONS THROUGH AERIAL IMAGERY ANALYSIS	

REQUEST FOR CERTIFICATE OF CORRECTION UNDER 37 C.F.R. § 1.322

MAIL STOP CERTIFICATES OF CORRECTION BRANCH
COMMISSIONER FOR PATENTS
P.O. BOX 1450
ALEXANDRIA, VIRGINIA 22313

Commissioner:

It is requested that a Certificate of Correction be issued under 37 C.F.R. § 1.322 correcting an error appearing in the above-identified United States patent. A copy of the text of the Certificate in the suggested form is enclosed. The supporting text for which may be found on page 30, paragraph [0082] of the specification as filed on January 3, 2020.

Applicant does not believe that any fees are due at this time. If, however, any fees are required, then the Commissioner is authorized to charge such fees to Gardella Grace P.A. deposit account number 601484, referencing docket number 474139US02.

Respectfully submitted,
GARDELLA GRACE. P.A.

/Natalie J. Grace/
Natalie J. Grace
Attorney of Record
Registration No. 65,803

Date: June 3, 2020

GARDELLA GRACE P.A.
80 M Street SE, 1st Floor
Washington, DC 20003
Telephone: (703) 556-9600
Facsimile: (703) 740-4541

UNITED STATES PATENT AND TRADEMARK OFFICE CERTIFICATE OF CORRECTION

Page 1 of 1

PATENT NO. : 10,650,285

APPLICATION NO.: 16/733,888

ISSUE DATE : May 12, 2020

INVENTOR(S) : Takeshi Okazaki

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 17, Line 38, "seventies" should read as --severities--.

MAILING ADDRESS OF SENDER (Please do not use Customer Number below):

Gardella Grace P.A.
80 M Street SE, 1st Floor
Washington, DC 20003

This collection of information is required by 37 CFR 1.322, 1.323, and 1.324. 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 1.0 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: Attention Certificate of Corrections Branch, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

Privacy Act Statement

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

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

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

Electronic Acknowledgement Receipt	
EFS ID:	39613356
Application Number:	16733888
International Application Number:	
Confirmation Number:	5317
Title of Invention:	Platform, Systems, and Methods for Identifying Property Characteristics and Property Feature Conditions Through Aerial Imagery Analysis
First Named Inventor/Applicant Name:	Takeshi Okazaki
Customer Number:	146018
Filer:	Natalie J. Grace/Kristin Sims
Filer Authorized By:	Natalie J. Grace
Attorney Docket Number:	474139US02
Receipt Date:	03-JUN-2020
Filing Date:	03-JAN-2020
Time Stamp:	15:23:03
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no				
File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Certificate of Correction	474139US02_COC_Request.pdf	262493 6fb9550105abc9f77a9cf5f7cd8ca05fd1b4270	no	3
Warnings:					

Information:	
Total Files Size (in bytes):	262493
<p>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.</p> <p><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.</p> <p><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.</p> <p><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.</p>	

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 10,650,285 B1
APPLICATION NO. : 16/733888
DATED : May 12, 2020
INVENTOR(S) : Takeshi Okazaki

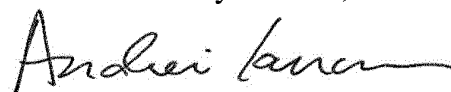
Page 1 of 1

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Specification

Column 17, Line 38, "seventies" should read as --severities--.

Signed and Sealed this
Thirtieth Day of June, 2020

A handwritten signature in black ink, appearing to read "Andrei Iancu", written in a cursive style.

Andrei Iancu
Director of the United States Patent and Trademark Office

STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: Aon Re, Inc.

Application No./Patent No.: 10,650,285 Filed/Issue Date: May 12, 2020

Titled: PLATFORM, SYSTEMS, AND METHODS FOR IDENTIFYING PROPERTY CHARACTERISTICS AND PROPERTY FEATURE CONDITIONS THROUGH AERIAL IMAGERY ANALYSIS

Aon Re, Inc., a corporation

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

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

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

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

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

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

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

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

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

1. From: Takeshi Okazaki To: Aon Benfield Inc.

The document was recorded in the United States Patent and Trademark Office at
Reel 050623, Frame 0112, or for which a copy thereof is attached.

2. From: Aon Benfield Inc. To: Aon Re, Inc.

The document was recorded in the United States Patent and Trademark Office at
Reel 068292, Frame 0838, or for which a copy thereof is attached.

[Page 1 of 2]

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

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

4. From: _____ To: _____

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

5. From: _____ To: _____

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

6. From: _____ To: _____

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

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

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

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

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

/Natalie J. Grace/

August 29, 2024

Signature

Date

Natalie J. Grace

65,803

Printed or Typed Name

Title or Registration Number

Privacy Act Statement

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

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

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



ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #
16/733,888

RECEIPT DATE / TIME
08/29/2024 04:56:12 PM Z ET

ATTORNEY DOCKET #
474139US02

Title of Invention

Platform, Systems, and Methods for Identifying Property Characteristics and Property Feature Conditions Through Aerial Imagery Analysis

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	10650285
CONFIRMATION #	5317	FILED BY	Donna O'Callaghan
PATENT CENTER #	66975806	FILING DATE	01/03/2020
CUSTOMER #	146018	FIRST NAMED INVENTOR	Takeshi Okazaki
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Natalie Grace

Documents

TOTAL DOCUMENTS: 2

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
AON00005USC1 - Statement of Ownership - TBF.pdf	3	Assignee showing of ownership per 37 CFR 3.73	1679 KB
AON00005USC1 - Aon Re Inc_Executed POA_tbf.pdf	2	Power of Attorney	399 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
AON00005USC1 - Statement of Ownership - TBF.pdf	ED628472EFCAD158C07263CA029343F96007697CBDF21FD3B2A2823DDB26161AA6F260E982B0A45F2AD64AC9BB3E6F965022F10258B68D34893924F4E34DE594

AON00005USC1 - Aon Re
Inc_Executed POA_tbf.pdf

DC6F61F9B98FE5E2941E8527B4BA3DBAFDC4EB976BD9500B
40A8C84283DCBCD09BCF372FC1D87C58E8FE8AD65703AAC
40F8E317A5F9C51E844FE7D32C9EA6FC8

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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

POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

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

I hereby appoint:

☒

Practitioners associated with Customer Number: 51886

OR☐

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

Name	Registration Number

Name	Registration Number

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

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

☒

The address associated with Customer Number: 51886

OR☐

Firm or individual name

Address

City

State

Zip

Country

Telephone

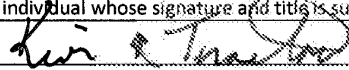
Email

Assignee name and address:

Aon Re, Inc.
200 East Randolph Street, Chicago, Illinois 60601**A copy of this form, together with a statement under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(c) may be completed by one of the practitioners appointed in this form, and must identify the application in which this Power of Attorney is to be filed.****SIGNATURE of Assignee of Record**

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

Signature



Date

June 18, 2024

Name Kevin R. Traetow

Telephone

452-886-8164

Title Co-President

A Federal agency may not conduct or sponsor, and a person is not required to respond to, nor shall a person be subject to a penalty for failure to comply with an information collection subject to the requirements of the Paperwork Reduction Act of 1995, unless the information collection has a currently valid OMB Control Number. The OMB Control Number for this information collection is 0651-0035. Public burden for this form is estimated to average 18 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the information collection. Send comments regarding this burden estimate or any other aspect of this information collection, including suggestions for reducing this burden to the Chief Administrative Officer, United States Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450 or email InformationCollection@uspto.gov. **DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS.** If filing this completed form by mail, send to: **Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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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. The United States Patent and Trademark Office (USPTO) collects the information in this record under authority of 35 U.S.C. 2. The USPTO's system of records is used to manage all applicant and owner information including name, citizenship, residence, post office address, and other information with respect to inventors and their legal representatives pertaining to the applicant's/owner's activities in connection with the invention for which a patent is sought or has been granted. The applicable Privacy Act System of Records Notice for the information collected in this form is COMMERCE/PAT-TM-7 Patent Application Files, available in the Federal Register at 78 FR 19243 (March 29, 2013). <https://www.govinfo.gov/content/pkg/FR-2013-03-29/pdf/2013-07341.pdf>

Routine uses of the information in this record may include disclosure to: 1) law enforcement, in the event that the system of records indicates a violation or potential violation of law; 2) a Federal, state, local, or international agency, in response to its request; 3) a contractor of the USPTO having need for the information in order to perform a contract; 4) the Department of Justice for determination of whether the Freedom of Information Act (FOIA) requires disclosure of the record; 5) a Member of Congress submitting a request involving an individual to whom the record pertains, when the individual has requested the Member's assistance with respect to the subject matter of the record; 6) a court, magistrate, or administrative tribunal, in the course of presenting evidence, including disclosures to opposing counsel in the course of settlement negotiations; 7) the Administrator, General Services Administration (GSA), or their designee, during an inspection of records conducted by GSA under authority of 44 U.S.C. 2904 and 2906, in accordance with the GSA regulations and any other relevant (i.e., GSA or Commerce) directive, where such disclosure shall not be used to make determinations about individuals; 8) 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)); 9) the Office of Personnel Management (OPM) for personnel research purposes; and 9) the Office of Management and Budget (OMB) for legislative coordination and clearance.

If you do not furnish the information requested on this form, the USPTO may not be able to process and/or examine your submission, which may result in termination of proceedings, abandonment of the application, and/or expiration of the patent.

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Additional USPTO uses of the information in this record may include disclosure to: 1) the International Bureau of the World Intellectual Property Organization, if the record is related to an international application filed under the Patent Cooperation Treaty; 2) the public i) after publication of the application pursuant to 35 U.S.C. 122(b), ii) after issuance of a patent pursuant to 35 U.S.C. 151, iii) 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, or iv) without publication of the application or patent under the specific circumstances provided for by 37 CFR 1.14(a)(1)(v)-(vii); and/or 3) the National Archives and Records Administration, for inspection of records.



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UNITED STATES DEPARTMENT OF COMMERCE
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www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/733,888	01/03/2020	Takeshi Okazaki	474139US02

51886
Finch & Maloney PLLC
50 Commercial St.
Suite 300
Manchester, NH 03101

CONFIRMATION NO. 5317
POA ACCEPTANCE LETTER



OC000000077783937

Date Mailed: 09/12/2024

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 08/29/2024.

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

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

/dtdinh/



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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/733,888	01/03/2020	Takeshi Okazaki	474139US02

146018
Gardella Grace P.A.
80 M Street SE, 1st Floor
Washington, DC 20003

CONFIRMATION NO. 5317

POWER OF ATTORNEY NOTICE



OC000000077783893

Date Mailed: 09/12/2024

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 08/29/2024.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

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

/dtdinh/