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(54) **INTEGRATED CENTRALIZED PROPERTY DATABASE SYSTEMS AND METHODS**

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(56) **References Cited**

U.S. PATENT DOCUMENTS

2,273,876 A 2/1942 Lutz et al.
3,153,784 A 10/1964 Petrides et al.
3,594,556 A 7/1971 Edwards
3,614,410 A 10/1971 Bailey
3,621,326 A 11/1971 Hobrough
3,661,061 A 5/1972 Tokarz
3,716,669 A 2/1973 Watanabe et al.
3,725,563 A 4/1973 Woycechowsky
3,864,513 A 2/1975 Halajian et al.
3,866,602 A 2/1975 Furihata
3,877,799 A 4/1975 O'Donnell
4,015,080 A 3/1977 Moore-Searson
(Continued)

FOREIGN PATENT DOCUMENTS

AT 331204 T 7/2006
BR 0316110 9/2005
(Continued)

OTHER PUBLICATIONS

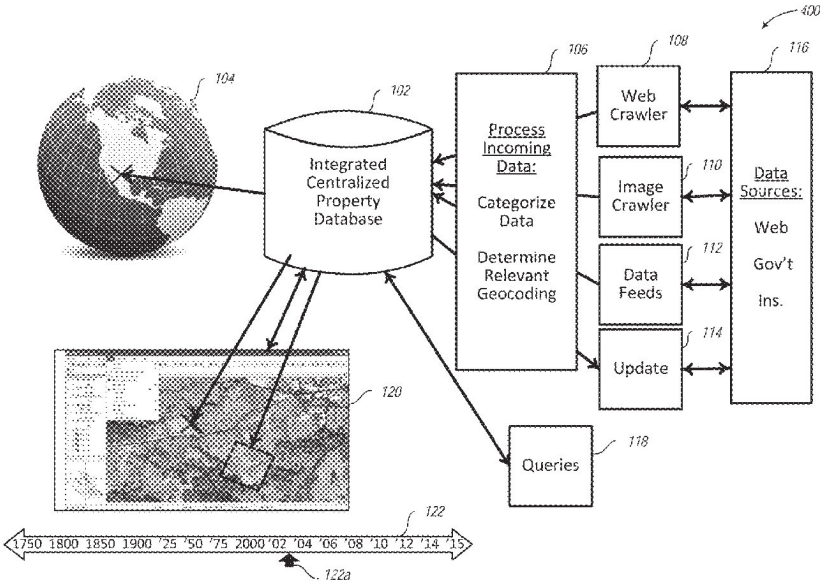
Pictometry International Corp., Electronic Field Study User Guide Version 2.7 (filed as Exhibit-1004 in IPR2016-00593), copyright Jul. 2007.
(Continued)

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(57) **ABSTRACT**

A method is provided that includes storing a plurality of data items in a data aggregation system. Each of the plurality of data items is associated with one or more location identifiers indicating a particular point on the earth. The method further includes receiving, by at least one processor, a query indicating a geographic location. Data items having associated location identifiers matching the received geographic location are retrieved from the data aggregation system. The method further includes outputting the retrieved data items.

18 Claims, 6 Drawing Sheets



Nearmap US Exhibit 1001
Nearmap US, Inc. v. Eagle View Techs., Inc.
IPR2024-00716
Page 00001

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,044,879	A	8/1977	Stahl	
4,184,711	A	1/1980	Wakimoto	
4,240,108	A	12/1980	Levy	
4,281,354	A	7/1981	Conte	
4,344,683	A	8/1982	Stemme	
4,360,876	A	11/1982	Girault et al.	
4,382,678	A	5/1983	Thompson et al.	
4,387,056	A	6/1983	Stowe	
4,396,942	A	8/1983	Gates	
4,463,380	A	7/1984	Hooks	
4,489,322	A	12/1984	Zulch et al.	
4,490,742	A	12/1984	Wurtzinger	
4,491,399	A	1/1985	Bell	
4,495,500	A	1/1985	Vickers	
4,527,055	A	7/1985	Harkless et al.	
4,543,603	A	9/1985	Laures	
4,586,138	A	4/1986	Mullenhoff et al.	
4,635,136	A	1/1987	Ciampa et al.	
4,653,136	A	3/1987	Denison	
4,653,316	A	3/1987	Fukuhara	
4,673,988	A	6/1987	Jansson et al.	
4,686,474	A	8/1987	Olsen et al.	
4,688,092	A	8/1987	Kamel et al.	
4,689,748	A	8/1987	Hofmann	
4,707,698	A	11/1987	Constant et al.	
4,758,850	A	7/1988	Archdale et al.	
4,805,033	A	2/1989	Nishikawa	
4,807,024	A	2/1989	Mclaurin et al.	
4,814,711	A	3/1989	Olsen et al.	
4,814,896	A	3/1989	Heitzman et al.	
4,843,463	A	6/1989	Michetti	
4,899,296	A	2/1990	Khattak	
4,906,198	A	3/1990	Cosimano et al.	
4,953,227	A	8/1990	Katsuma et al.	
4,956,872	A	9/1990	Kimura	
5,034,812	A	7/1991	Rawlings	
5,086,314	A	2/1992	Aoki et al.	
5,121,222	A	6/1992	Endoh et al.	
5,138,444	A	8/1992	Hiramatsu	
5,155,597	A	10/1992	Lareau et al.	
5,164,825	A	11/1992	Kobayashi et al.	
5,166,789	A	11/1992	Myrick	
5,191,174	A	3/1993	Chang et al.	
5,200,793	A	4/1993	Ulich et al.	
5,210,586	A	5/1993	Grage et al.	
5,231,435	A	7/1993	Blakely	
5,247,356	A	9/1993	Ciampa	
5,251,037	A	10/1993	Busenberg	
5,265,173	A	11/1993	Griffin et al.	
5,267,042	A	11/1993	Tsuchiya et al.	
5,270,756	A	12/1993	Busenberg	
5,296,884	A	3/1994	Honda et al.	
5,335,072	A	8/1994	Tanaka et al.	
5,342,999	A	8/1994	Frei et al.	
5,345,086	A	9/1994	Bertram	
5,353,055	A	10/1994	Hiramatsu	
5,369,443	A	11/1994	Woodham	
5,402,170	A	3/1995	Parulski et al.	
5,414,462	A	5/1995	Veatch	
5,467,271	A	11/1995	Abel et al.	
5,481,479	A	1/1996	Wight et al.	
5,486,948	A	1/1996	Imai et al.	
5,506,644	A	4/1996	Suzuki et al.	
5,508,736	A	4/1996	Cooper	
5,555,018	A	9/1996	von Braun	
5,604,534	A	2/1997	Hedges et al.	
5,617,224	A	4/1997	Ichikawa et al.	
5,633,946	A	5/1997	Lachinski et al.	
5,668,593	A	9/1997	Lareau et al.	
5,677,515	A	10/1997	Selk et al.	
5,794,216	A	8/1998	Brown	
5,798,786	A	8/1998	Lareau et al.	
5,835,133	A	11/1998	Moreton et al.	
5,841,574	A	11/1998	Willey	
5,844,602	A	12/1998	Lareau et al.	
5,852,753	A	12/1998	Lo et al.	
5,852,810	A	12/1998	Sotiroff et al.	
5,894,323	A	4/1999	Kain et al.	
5,899,945	A	5/1999	Baylocq et al.	
5,963,664	A	10/1999	Kumar et al.	
6,037,945	A	3/2000	Loveland	
6,088,055	A	7/2000	Lareau et al.	
6,094,215	A	7/2000	Sundahl et al.	
6,097,854	A	8/2000	Szeliski et al.	
6,108,032	A	8/2000	Hoagland	
6,130,705	A	10/2000	Lareau et al.	
6,157,747	A	12/2000	Szeliski et al.	
6,167,300	A	12/2000	Cherepenin et al.	
6,222,583	B1	4/2001	Matsumura et al.	
6,236,886	B1	5/2001	Cherepenin et al.	
6,256,057	B1	7/2001	Mathews et al.	
6,373,522	B2	4/2002	Mathews et al.	
6,421,610	B1	7/2002	Carroll et al.	
6,434,280	B1	8/2002	Peleg et al.	
6,597,818	B2	7/2003	Kumar et al.	
6,639,596	B1	10/2003	Shum et al.	
6,711,475	B2	3/2004	Murphy	
6,731,329	B1	5/2004	Feist et al.	
6,747,686	B1	6/2004	Bennett	
6,810,383	B1	10/2004	Loveland	
6,816,819	B1	11/2004	Loveland	
6,826,539	B2	11/2004	Loveland	
6,829,584	B2	12/2004	Loveland	
6,834,128	B1	12/2004	Altunbasak et al.	
6,876,763	B2	4/2005	Sorek et al.	
7,009,638	B2	3/2006	Gruber et al.	
7,018,050	B2	3/2006	Ulichney et al.	
7,046,401	B2	5/2006	Dufaux et al.	
7,061,650	B2	6/2006	Walmsley et al.	
7,065,260	B2	6/2006	Zhang et al.	
7,123,382	B2	10/2006	Walmsley et al.	
7,127,348	B2	10/2006	Smitherman et al.	
7,133,551	B2	11/2006	Chen	
7,142,984	B2	11/2006	Rahmes et al.	
7,184,072	B1	2/2007	Loewen et al.	
7,233,691	B2	6/2007	Setterholm	
7,262,790	B2	8/2007	Bakewell	
7,348,895	B2	3/2008	Lagassey	
7,509,241	B2	3/2009	Guo	
7,728,833	B2	6/2010	Verma	
7,832,267	B2	11/2010	Woro	
7,844,499	B2	11/2010	Yahiro	
8,078,396	B2	12/2011	Meadow	
8,705,843	B2	4/2014	Lieckfeldt	
9,927,941	B2 *	3/2018	Steimle	G16H 10/40
2002/0041328	A1	4/2002	LeCompte et al.	
2002/0041717	A1	4/2002	Murata et al.	
2002/0114536	A1	8/2002	Xiong et al.	
2003/0014224	A1	1/2003	Guo et al.	
2003/0043824	A1	3/2003	Remboski et al.	
2003/0088362	A1	5/2003	Melero et al.	
2003/0164962	A1	9/2003	Nims et al.	
2003/0214585	A1	11/2003	Bakewell	
2004/0105090	A1	6/2004	Schultz et al.	
2004/0167709	A1	8/2004	Smitherman et al.	
2005/0073241	A1	4/2005	Yamauchi et al.	
2005/0088251	A1	4/2005	Matsumoto	
2005/0169521	A1	8/2005	Hel-Or	
2005/0288957	A1	12/2005	Eraker et al.	
2006/0028550	A1	2/2006	Palmer et al.	
2006/0092043	A1	5/2006	Lagassey	
2006/0238383	A1	10/2006	Kimchi et al.	
2006/0250515	A1	11/2006	Koseki et al.	
2007/0024612	A1	2/2007	Balfour	
2007/0046448	A1	3/2007	Smitherman	
2007/0237420	A1	10/2007	Steedly et al.	
2008/0120031	A1	5/2008	Rosenfeld et al.	
2008/0123994	A1	5/2008	Schultz et al.	
2008/0158256	A1	7/2008	Russell et al.	
2009/0063424	A1 *	3/2009	Iwamura	G06F 16/29
2009/0177458	A1	7/2009	Hochart et al.	
2009/0208095	A1	8/2009	Zebedin	
2009/0304227	A1	12/2009	Kennedy et al.	
2010/0296693	A1	11/2010	Thornberry et al.	

(56) **References Cited**

U.S. PATENT DOCUMENTS

2011/0033110 A1	2/2011	Shimamura et al.	
2012/0101783 A1	4/2012	Stephens et al.	
2013/0246204 A1	9/2013	Thornberry et al.	
2014/0280269 A1	9/2014	Schultz et al.	
2016/0210326 A1*	7/2016	Tolman	G06F 16/24539

FOREIGN PATENT DOCUMENTS

CA	2402234		9/2000
CA	2505566		5/2004
CN	1735897	A	2/2006
DE	60017384	T	3/2006
DE	60306301	T	11/2006
DK	1418402	T	10/2006
EP	1010966		2/1999
EP	1180967		2/2002
EP	1418402		5/2004
EP	1696204		8/2006
EP	1903491	A1	3/2008
ES	2266704	T	3/2007
JP	2003/317089	A	11/2003
MX	PA05004987		2/2006
WO	WO99/18732		4/1999
WO	WO/2000/053090		9/2000
WO	WO/2004/044692		5/2004
WO	WO/2005/088251		9/2005
WO	WO/2008/028040		3/2008

OTHER PUBLICATIONS

Ackermann, Prospects of Kinematic GPS Aerial Triangulation, ITC Journal, 1992.

Ciampa, John A., "Pictometry Digital Video Mapping", SPIE, vol. 2598, pp. 140-148, 1995.

Ciampa, J. A., Oversee, Presented at Reconstruction After Urban earthquakes, Buffalo, NY, 1989.

Dunford et al., Remote Sensing for Rural Development Planning in Africa, The Journal for the International Institute for Aerial Survey and Earth Sciences, 2:99-108, 1983.

Gagnon, P.A., Agnard, J. P., Nolette, C., & Boulianne, M., "A Micro-Computer based General Photogrammetric System", Photogrammetric Engineering and Remote Sensing, vol. 56, No. 5., pp. 623-225, 1990.

Konecny, G., "Issues of Digital Mapping", Leibniz University Hannover, Germany, GIS Ostrava 2008, Ostrava 27.—Jan. 30, 2008, pp. 1-8.

Konecny, G., "Analytical Aerial Triangulation with Convergent Photography", Department of Surveying Engineering, University of New Brunswick, pp. 37-57, 1966.

Konecny, G., "Interior Orientation and Convergent Photography", Photogrammetric Engineering, pp. 625-634, 1965.

Graham, Lee A., "Airborne Video for Near-Real-Time Vegetation Mapping", Journal of Forestry, 8:28-32, 1993.

Graham, Horita TRG-50 SMPTE Time-Code Reader, Generator, Window Inserter, 1990.

Hess, L.L, et al., "Geocoded Digital Videography for Validation of Land Cover Mapping in the Amazon Basin", International Journal of Remote Sensing, vol. 23, No. 7, pp. 1527-1555, 2002.

Hinthorne, J., et al., "Image Processing in The Grass GIS", Geoscience and Remote Sensing Symposium, 4:2227-2229, 1991.

Imhof, Ralph K., "Mapping from Oblique Photographs", Manual of Photogrammetry, Chapter 18, 1966.

Jensen, John R., Introductory Digital Image Processing: A Remote Sensing Perspective, Prentice-Hall, 1986; 399 pages.

Lapine, Lewis A., "Practical Photogrammetric Control by Kinematic GPS", GPS World, 1(3):44-49, 1990.

Lapine, Lewis A., Airborne Kinematic GPS Positioning for Photogrammetry—The Determination of the Camera Exposure Station, Silver Spring, MD, 11 pages, at least as early as 2000.

Linden et al., Airborne Video Automated Processing, US Forest Service Internal report, Fort Collins, CO, 1993.

Myhre, Dick, "Airborne Video System Users Guide", USDA Forest Service, Forest Pest Management Applications Group, published by Management Assistance Corporation of America, 6 pages, 1992.

Myhre et al., "An Airborne Video System Developed Within Forest Pest Management—Status and Activities", 10 pages, 1992.

Myhre et al., "Airborne Videography—A Potential Tool for Resource Managers"—Proceedings: Resource Technology 90, 2nd International Symposium on Advanced Technology in Natural Resource Management, 5 pages, 1990.

Myhre et al., Aerial Photography for Forest Pest Management, Proceedings of Second Forest Service Remote Sensing Applications Conference, Slidell, Louisiana, 153-162, 1988.

Myhre et al., "Airborne Video Technology", Forest Pest Management/Methods Application Group, Fort Collins, CO, pp. 1-6, at least as early as Jul. 30, 2006.

Norton-Griffiths et al., 1982. "Sample surveys from light aircraft combining visual observations and very large scale color photography". University of Arizona Remote Sensing Newsletter 82-2:1-4.

Norton-Griffiths et al., "Aerial Point Sampling for Land Use Surveys", Journal of Biogeography, 15:149-156, 1988.

Novak, Rectification of Digital Imagery, Photogrammetric Engineering and Remote Sensing, 339-344, 1992.

Slaymaker, Dana M., "Point Sampling Surveys with GPS-logged Aerial Videography", Gap Bulletin No. 5, University of Idaho, http://www.gap.uidaho.edu/Bulletins/5/PSSwGPS.html, 1996.

Slaymaker, et al., "Madagascar Protected Areas Mapped with GPS-logged Aerial Video and 35mm Air Photos", Earth Observation magazine, vol. 9, No. 1, http://www.eomonline.com/Common/Archives/2000jan/00jan_tableofcontents.html, pp. 1-4, 2000.

Slaymaker, et al., "Cost-effective Determination of Biomass from Aerial Images", Lecture Notes in Computer Science, 1737:67-76, http://portal.acm.org/citation.cfm?id=648004.74267&coll=GUIDE&dl=, 1999.

Slaymaker, et al., "A System for Real-time Generation of Georeferenced Terrain Models", 4232A-08, SPIE Enabling Technologies for Law Enforcement Boston, MA, ftp://vis-ftp.cs.umass.edu/Papers/schultz/spie2000.pdf, 2000.

Slaymaker, et al., "Integrating Small Format Aerial Photography, Videography, and a Laser Profiler for Environmental Monitoring", In ISPRS WG III/1 Workshop on Integrated Sensor Calibration and Orientation, Portland, Maine, 1999.

Slaymaker, et al., "Calculating Forest Biomass With Small Format Aerial Photography, Videography and a Profiling Laser", In Proceedings of the 17th Biennial Workshop on Color Photography and Videography in Resource Assessment, Reno, NV, 1999.

Slaymaker et al., Mapping Deciduous Forests in Southern New England using Aerial Videography and Hyperclustered Multi-Temporal Landsat TM Imagery, Department of Forestry and Wildlife Management, University of Massachusetts, 1996.

Star et al., "Geographic Information Systems an Introduction", Prentice-Hall, 1990.

Tomasi et al., "Shape and Motion from Image Streams: a Factorization Method"—Full Report on the Orthographic Case, pp. 9795-9802, 1992.

Warren, Fire Mapping with the Fire Mousetrap, Aviation and Fire Management, Advanced Electronics System Development Group, USDA Forest Service, 1986.

Welch, R., "Desktop Mapping with Personal Computers", Photogrammetric Engineering and Remote Sensing, 1651-1662, 1989.

Westervelt, James, "Introduction to Grass 4", pp. 1-25, 1991.

"RGB Spectrum Videographics Report, vol. 4, No. 1, McDonnell Douglas Integrates RGB Spectrum Systems in Helicopter Simulators", pp. 1-6, 1995.

RGB "Computer Wall", RGB Spectrum, 4 pages, 1995.

"The First Scan Converter with Digital Video Output", Introducing . . . The RGB/Videolink 1700D-1, RGB Spectrum, 2 pages, 1995.

ERDAS Field Guide, Version 7.4, A Manual for a commercial image processing system, 1990.

(56) **References Cited**

OTHER PUBLICATIONS

"Image Measurement and Aerial Photography", Magazine for all branches of Photogrammetry and its fringe areas, Organ of the German Photogrammetry Association, Berlin—Wilmersdorf, No. 1, 1958.
"Airvideo Analysis", Microlmages, Inc., Lincoln, NE, 1 page, Dec. 1992.
Zhu, Zhigang, Hanson, Allen R., "Mosaic-Based 3D Scene Representation and Rendering", Image Processing, 2005, ICIP 2005, IEEE International Conference on 1(2005).
Mostafa, et al., "Direct Positioning and Orientation Systems How do they Work? What is the Attainable Accuracy?", Proceeding, American Society of Photogrammetry and Remote Sensing Annual Meeting, St. Louis, MO, Apr. 24-27, 2001.
"POS AV" georeferenced by Applanix aided inertial technology, http://www.applanix.com/products/posav_index.php.
Mostafa, et al., "Ground Accuracy from Directly Georeferenced Imagery", Published in GIM International vol. 14 N. 12 Dec. 2000.
Mostafa, et al., "Airborne Direct Georeferencing of Frame Imagery: An Error Budget", The 3rd International Symposium on Mobile Mapping Technology, Cairo, Egypt, Jan. 3-5, 2001.
Mostafa, M.R. and Hutton, J., "Airborne Kinematic Positioning and Attitude Determination Without Base Stations", Proceedings, International Symposium on Kinematic Sysems in Geodesy, Geomatics, and Navigation (KIS 2001) Banff, Alberta, Canada, Jun. 4-8, 2001.
Mostafa, et al., "Airborne DGPS Without Dedicated Base Stations for Mapping Applications", Proceedings of ION-GPS 2001, Salt Lake City, Utah, USA, Sep. 11-14.
Mostafa, "ISAT Direct Exterior Orientation QA/QC Strategy Using POS Data", Proceedings of OEEPE Workshop: Integrated Sensor Orientation, Hanover, Germany, Sep. 17-18, 2001.
Mostafa, "Camera/IMU Boresight Calibration: New Advances and Performance Analysis", Proceedings of the ASPRS Annual Meeting, Washington, D.C., Apr. 21-26, 2002.
Hiatt, "Sensor Integration Aids Mapping at Ground Zero", Photogrammetric Engineering and Remote Sensing, Sep. 2002, p. 877-878.
Mostafa, "Precision Aircraft GPS Positioning Using CORS", Photogrammetric Engineering and Remote Sensing, Nov. 2002, p. 1125-1126.
Mostafa, et al., System Performance Analysis of INS/DGPS Integrated System for Mobile Mapping System (MMS), Department of Geomatics Engineering, University of Calgary, Commission VI, WG VI/4, Mar. 2004.
Artes F., & Hutton, J., "GPS and Inertial Navigation Delivering", Sep. 2005, GEOconnexion International Magazine, p. 52-53, Sep. 2005.
"POS AV" APPLANIX, Product Outline, airborne@applanix.com, 3 pages, Mar. 28, 2007.
POSTrack, "Factsheet", APPLANIX, Ontario, Canada, www.applanix.com, Mar. 2007.
POS AV "Digital Frame Camera Applications", 3001 Inc., Brochure, 2007.
POS AV "Digital Scanner Applications", Earthdata Brochure, Mar. 2007.
POS AV "Film Camera Applications" AeroMap Brochure, Mar. 2007.
POS AV "LIDAR Applications" MD Atlantic Brochure, Mar. 2007.
POS AV "OEM System Specifications", 2005.
POS AV "Synthetic Aperture Radar Applications", Overview, Orbisat Brochure, Mar. 2007.
"POSTrack V5 Specifications" 2005.
"Remote Sensing for Resource Inventory Planning and Monitoring", Proceeding of the Second Forest Service Remote Sensing Applications Conference—Slidell, Louisiana and NSTL, Mississippi, Apr. 11-15, 1988.
"Protecting Natural Resources with Remote Sensing", Proceeding of the Third Forest Service Remote Sensing Applications Conference—Apr. 9-13, 1990.
Heipke, et al, "Test Goals and Test Set Up for the OEEPE Test—Integrated Sensor Orientation", 1999.
Kumar, et al., "Registration of Video to Georeferenced Imagery", Sarnoff Corporation, CN5300, Princeton, NJ, 1998.
McConnel, Proceedings Aerial Pest Detection and Monitoring Workshop—1994.pdf, USDA Forest Service Forest Pest Management, Northern Region, Intermountain region, Forest Insects and Diseases, Pacific Northwest Region.
"Standards for Digital Orthophotos ", National Mapping Program Technical Instructions, US Department of the Interior, Dec. 1996.
Tao, "Mobile Mapping Technology for Road Network Data Acquisition", Journal of Geospatial Engineering, vol. 2, No. 2, pp. 1-13, 2000.
"Mobile Mapping Systems Lesson 4", Lesson 4 SURE 382 Geographic Information Systems II, pp. 1-29, Jul. 2, 2006.
Konecny, G., "Mechanische Radialtriangulation mit Konvergentaufnahmen", Bildmessung and Luftbildwesen, 1958, Nr. 1.
Myhre, "ASPRS/ACSM/RT 92" Technical papers, Washington, D.C., vol. 5 Resource Technology 92, Aug. 3-8, 1992.
Rattigan, "Towns get new view from above," *The Boston Globe*, Sep. 5, 2002.
Mostafa, et al., "Digital image georeferencing from a multiple camera system by GPS/INS," *ISP RS Journal of Photogrammetry & Remote Sensing*, 56(I): I-12, Jun. 2001.
Dillow, "Grin, or bare it, for aerial shot," *Orange County Register* (California), Feb. 25, 2001.
Anonymous, "Live automatic coordinates for aerial images," *Advanced Imaging*, 12(6):51, Jun. 1997.
Anonymous, "Pictometry and US Geological Survey announce—Cooperative Research and Development Agreement," Press Release published Oct. 20, 1999.
Miller, "Digital software gives small Arlington the Big Picture," *Government Computer NewsState & Local*, 7(12), Dec. 2001.
Garrett, "Pictometry: Aerial photography on steroids," *Law Enforcement Technology* 29(7):114-116, Jul. 2002.
Weaver, "County gets an eyeful," *The Post-Standard* (Syracuse, NY), May 18, 2002.
Reed, "Firm gets latitude to map O.C. in 3D," *Orange County Register* (California), Sep. 27, 2000.
Reyes, "Orange County freezes ambitious aerial photography project," *Los Angeles Times*, Oct. 16, 2000.
Aerowest Pricelist of Geodata as of Oct. 21, 2005 and translations to English 3 pages.
www.archive.org Web site showing archive of German AeroDach Web Site http://www.aerodach.de from Jun. 13, 2004 (retrieved Sep. 20, 2012) and translations to English 4 pages.
AeroDach®Online Roof Evaluation Standard Delivery Format and 3D Data File: Document Version 01.00.2002 with publication in 2002, 13 pages.
Noronha et al., "Detection and Modeling of Building from Multiple Aerial Images," Institute for Robotics and Intelligent Systems, University of Southern California, Nov. 27, 2001, 32 pages.
Applicad Reports dated Nov. 25, 1999-Mar. 9, 2005, 50 pages.
Applicad Online Product Bulletin archive from Jan. 7, 2003, 4 pages.
Applicad Sorcerer Guide, Version 3, Sep. 8, 1999, 142 pages.
Xactimate Claims Estimating Software archive from Feb. 12, 2010, 8 pages.
Bignone et al, Automatic Extraction of Generic House Roofs from High Resolution Aerial Imagery, Communication Technology Laboratory, Swiss Federal Institute of Technology ETH, CH-8092 Zurich, Switzerland, 12 pages, 1996.
Geospan 2007 Job proposal.
Greening et al., Commercial Applications of GPS-Assisted Photogrammetry, Presented at GIS/LIS Annual Conference and Exposition, Phoenix, AZ, Oct. 1994.
Applanix Corp, Robust, Precise Position and Orientation Solutions, POS/AV & POS/DG Installation & Operation Manual, Redefining the way you survey, May 19, 1999, Ontario, Canada.
Applanix Corp, Robust, Precise Position and Orientation Solutions, POS/AV V4 Ethernet & Disk Logging ICD, Redefining the way you survey, Revision 3, Apr. 18, 2001, Ontario, Canada.

* cited by examiner

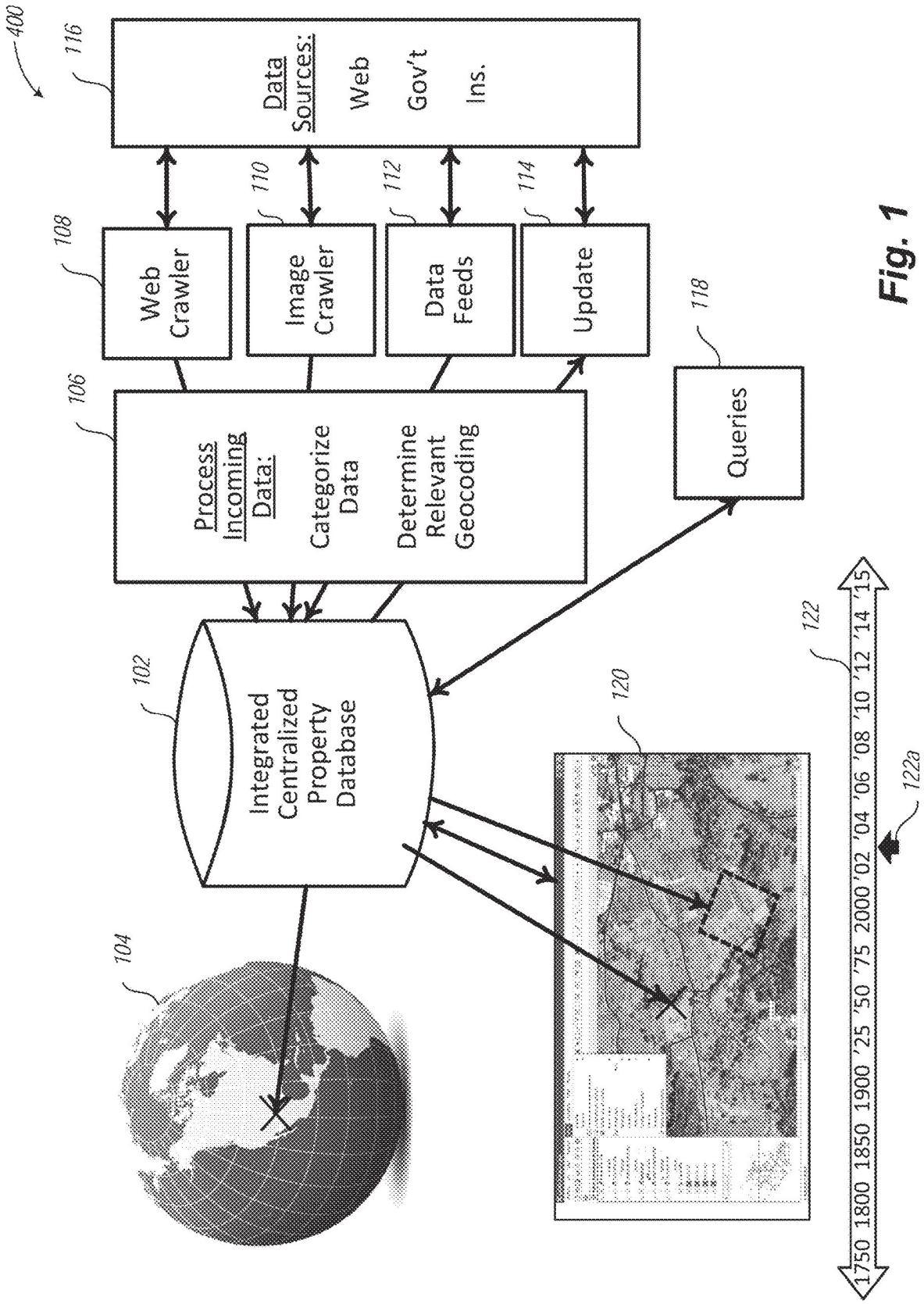

400
116
Data Sources:
Web
Gov't
Ins.
108
Web Crawler
110
Image Crawler
112
Data Feeds
114
Update
106
Process Incoming Data:
Categorize Data
Determine Relevant Geocoding
118
Queries
102
Integrated Centralized Property Database
104
120
122
1750 1800 1850 1900 '25 '50 '75 2000 '02 '04 '06 '08 '10 '12 '14 '15
122a

Fig. 1

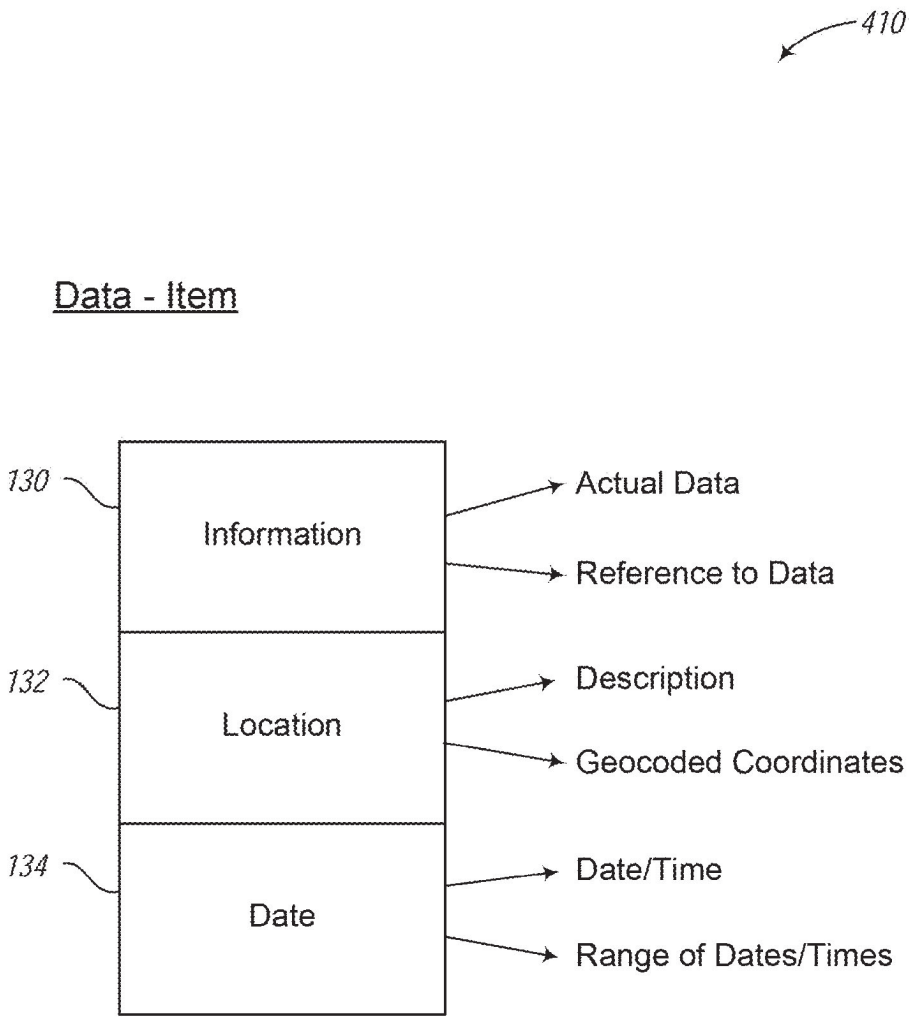

410
Data - Item
130
Information
Actual Data
Reference to Data
132
Location
Description
Geocoded Coordinates
134
Date
Date/Time
Range of Dates/Times

Fig. 2

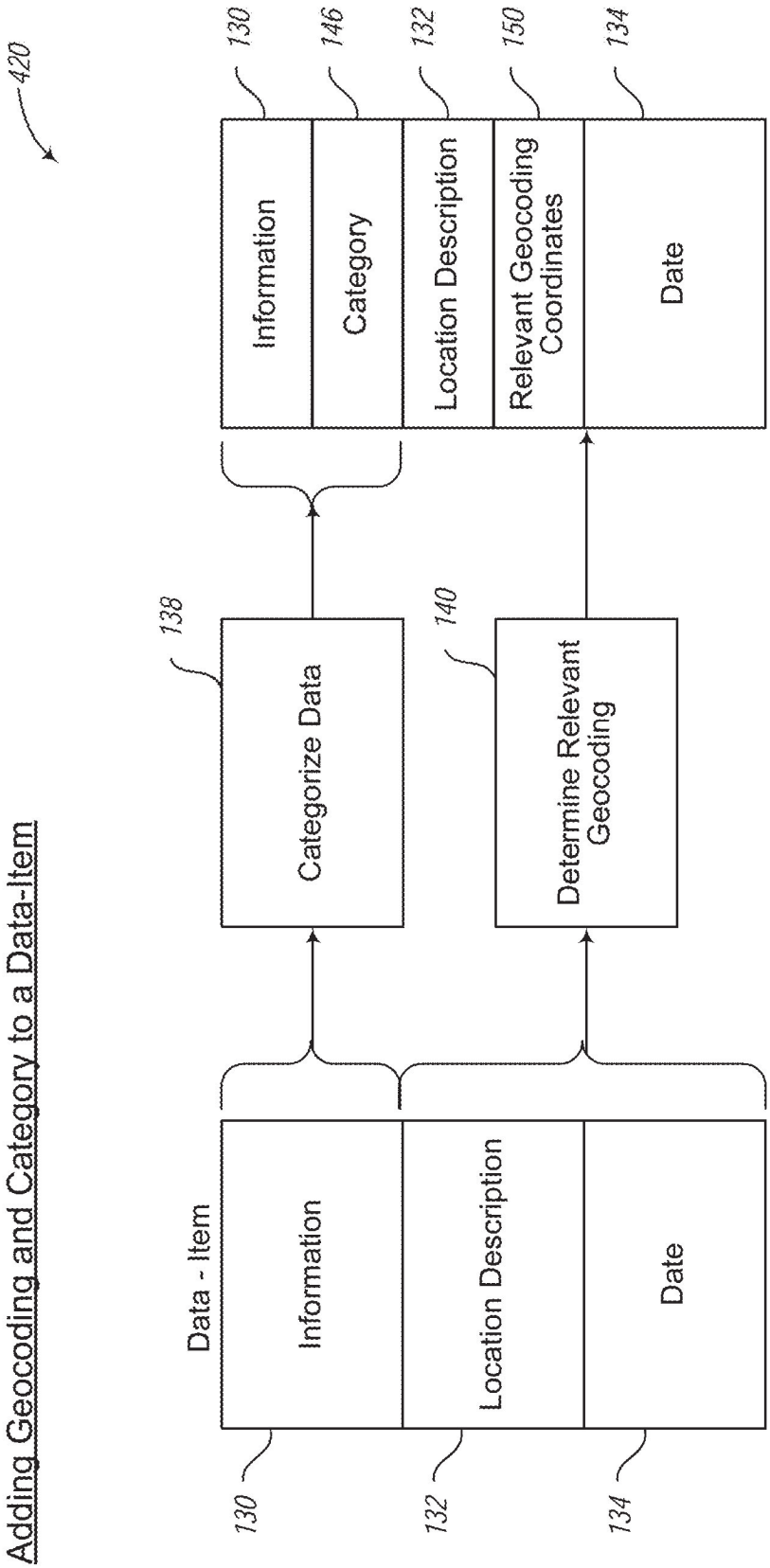

Adding Geocoding and Category to a Data-Item
420
Data - Item
Information
Location Description
Date
130
132
134
138
Categorize Data
140
Determine Relevant Geocoding
Information
Category
Location Description
Relevant Geocoding Coordinates
Date
130
146
132
150
134

Fig. 3

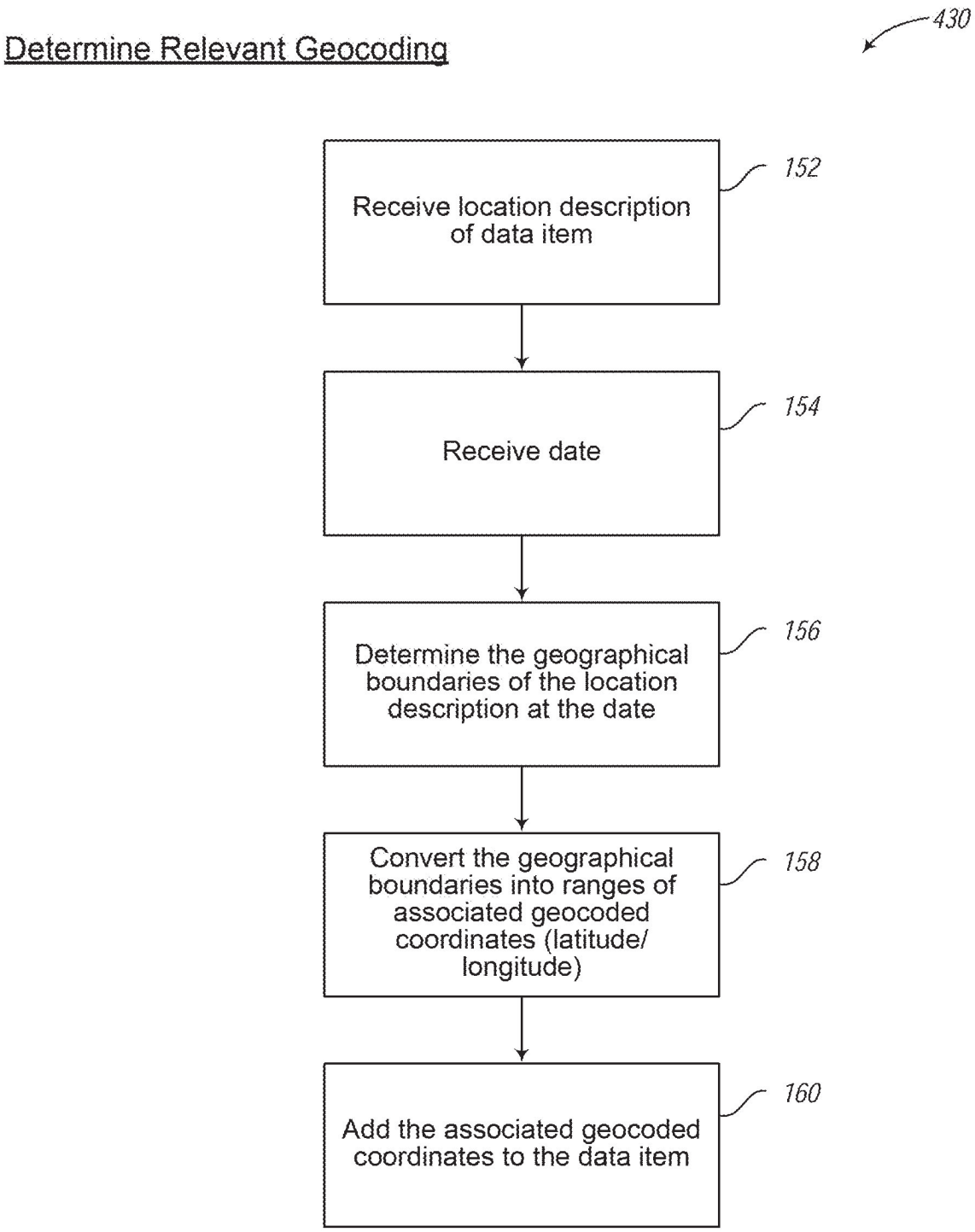


Fig. 4

Nearmap US Exhibit 1001
Nearmap US, Inc. v. Eagle View Techs., Inc.
IPR2024-00716
Page 00008

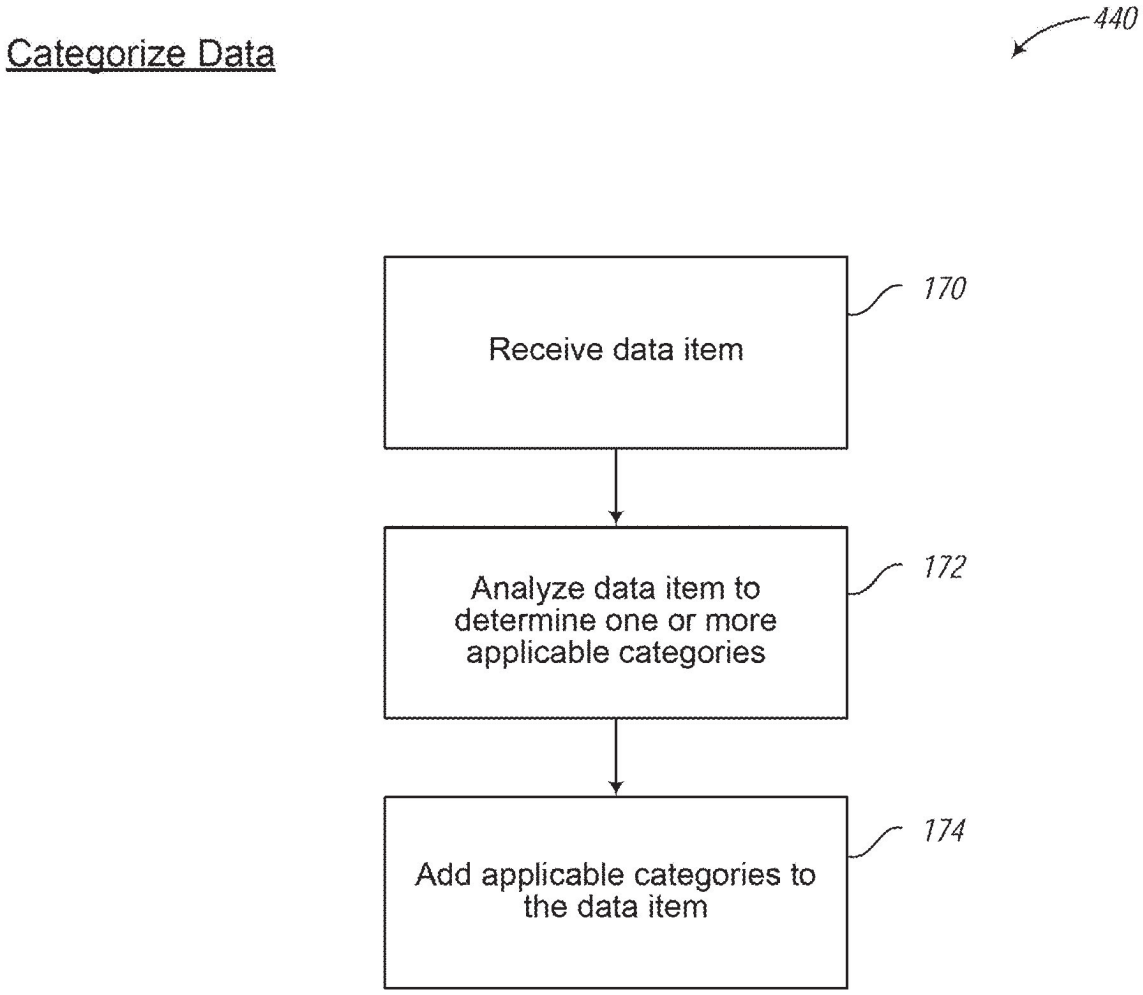

Categorize Data
440
Receive data item
170
Analyze data item to determine one or more applicable categories
172
Add applicable categories to the data item
174

Fig. 5

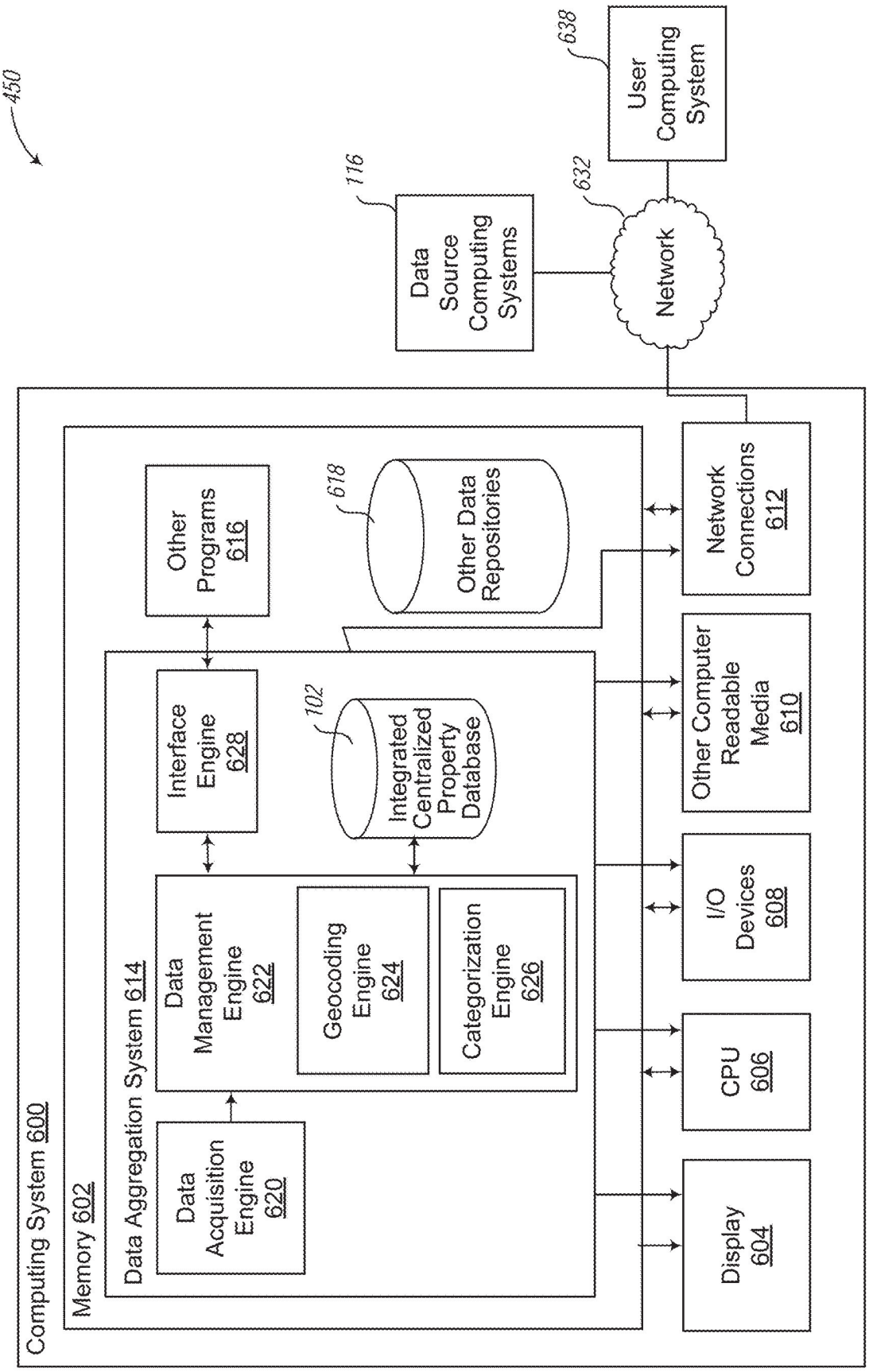

450
Computing System 600
Memory 602
Data Aggregation System 614
Data Acquisition Engine 620
Data Management Engine 622
Geocoding Engine 624
Categorization Engine 626
Interface Engine 628
102
Integrated Centralized Property Database
Other Programs 616
618
Other Data Repositories
Display 604
CPU 606
I/O Devices 608
Other Computer Readable Media 610
Network Connections 612
116
Data Source Computing Systems
632
Network
638
User Computing System

Fig. 6

INTEGRATED CENTRALIZED PROPERTY DATABASE SYSTEMS AND METHODS

BACKGROUND

Technical Field

This disclosure is in the field of aggregating information associated with all geographic points on the earth, where the information is captured from distributed data sources and integrated into a centralized database that may be queried for a complete time history of any geographic point on the earth.

Description of the Related Art

Information about property and the attributes of property, such as title information, geographic characteristics, insurance policies in force, and building and utility information, is usually publically available, but is stored by different entities in different locations using different formats. Some of the information is found by identifying an address or other number that identifies a real estate parcel and then contacting the record keeper of the type of information desired, such as a county records office, about the parcel number or address of the property. In some instances, information of interest may be more quickly found by using the Internet or an aggregator such as Zillow™ or Google Maps™ to access information about the property.

However, this approach to collecting data has a number of drawbacks. First, this data is tracked based on identifiers such as parcels, lots, townships, cities, ZIP Codes, school districts, and the like. These identifiers may have changed over time such that they represent different points on the earth at different times. Second, in the case of parcels, information may be out of date, and information related to the parcel or point of land will be stored in many different locations. In addition, it may be nearly impossible to identify and locate all available information that may relate to that parcel, for example events concerning the parcel that may not be in official county tax base or other government records. Further, many events are stored in different places and different databases. These include events such as crime events, news articles, or private photographs of the location over its various histories.

BRIEF SUMMARY

The present disclosure provides systems and methods to create and maintain an integrated centralized property database containing all information, including a full time history, associated with any given point on the earth. In some embodiments, this point may be identified by latitude and longitude coordinates.

The integrated centralized property database receives information from various data sources, which may include, for example, data sources accessible through the Internet, government databases relating to property, crime data, weather data and the like, as well as any other types of public or private data. The data sources may be located by web crawlers, image crawlers, data feeds or the like, and may be updated periodically to ensure the data stored in the integrated centralized property database is current.

The received data items may be processed to determine relevant category information (e.g., weather data, crime data, demographic data, property sales or change of ownership or classification data, tax assessment data, and so on). Further, the data items may be processed to determine or extract geocoding information, such as latitude, longitude and/or Z-axis information (i.e., height above or depth below the surface of the earth). The category and/or geocoding information may be associated with the data items for storage in the integrated centralized property database. As such, the integrated centralized property database may store a variety of information of all types which is related to one or more geographic points on the earth. Further, the data items may include or be associated with particular date or time information, for example, indicating a time or range of times to which the information pertains.

A user interface is provided which allows users to access the integrated centralized property database. Queries may be performed via the user interface and the integrated centralized property database will be searched for all relevant information associated with the query. For example, a user may input a specific latitude/longitude, and the system will retrieve, and output via the user interface, all relevant information associated with that particular latitude/longitude. The query may further include a time or range of times, in which case, the system will retrieve all relevant information associated with both the input location information (e.g., a particular latitude/longitude, an area defined by an input polygon or the like) and the input time information.

One benefit to the embodiments described herein is that a user can input a query about a location on the earth and receive, from a single database and single server, all activities and information associated with that location, sorted by date and type of activity/information.

One method to carry out one or more embodiments may be summarized as including: storing a plurality of data items in a data aggregation system, each of the plurality of data items being associated with one or more location identifiers indicating a particular point on the earth; receiving, by at least one processor, a query indicating a geographic location; retrieving, from the data aggregation system, data items having associated location identifiers matching the received geographic location; and outputting the retrieved data items.

The one or more location identifiers may include latitude and longitude coordinates of a geographic point on earth. The one or more location identifiers may further include Z-axis coordinates that identifies a distance above or below the earth.

The received geographic location may include a region on the earth. The region on the earth may be identified by multiple geocoded locations, the multiple geocoded locations described in at least latitude and longitude coordinates. At least a portion of the plurality of data items stored in the data aggregation system may further be associated with one or more time identifiers, and the method may further include: receiving, by the at least one processor, a time identifier, wherein retrieving from the data aggregation system may further include retrieving data items having associated time identifiers matching the received time identifier. The time identifier may include one or more time periods. The one or more location identifiers may include content external to the data aggregation system. The stored data items may include at least one of: tax data, building code data, weather data, insurance data, crime data, survey data, school data, demographic data and property data.

One system that can carry out one or more embodiments may be summarized as including: a computer processor; a memory coupled to the processor; and an integrated centralized property database, the processor being configured to: receive from a user computer a query including a location identifier, the location identifier including one of a geocoded location and multiple geocoded locations identifying a poly-

gon, receive from the user computer a time period identifier, retrieve from the integrated centralized property database location data, the location data including data associated with the location identifier and with the time period identifier, and provide the retrieved location data to the user computer via a graphical user interface.

The processor may be further configured to: retrieve parcel information from the integrated centralized property database; compare the retrieved parcel information with the location data to determine parcels associated with the location identifier; and output the parcels associated with the location identifier. The processor may be further configured to: retrieve insurance policy information from the integrated centralized property database; compare the retrieved insurance policy information with the parcels associated with the location identifier to determine the insurance policies associated with the location identifier; and output the insurance policies associated with the location identifier.

The system can be considered as having a means for storing a plurality of data items in a data aggregation system, each of the plurality of data items being associated with one or more location identifiers indicating a particular point on earth; means for receiving a query indicating a geographic location; means for retrieving data items having associated location identifiers matching the received geographic location; and means for outputting the retrieved data items.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

FIG. **1** is a block diagram illustrating an embodiment of an environment in which an integrated centralized property database is used.

FIG. **2** is a diagram showing the components of a data item, in accordance with one or more embodiments.

FIG. **3** is a block diagram illustrating a process for adding geocoding information and category information to a data item, in accordance with one or more embodiments.

FIG. **4** is a flowchart illustrating a process for determining relevant geocoding information, in accordance with one or more embodiments.

FIG. **5** is a flowchart illustrating a process for associating one or more categories to a data item, in accordance with one or more embodiments.

FIG. **6** is a block diagram illustrating a computing system for managing and providing access to the integrated centralized property database, in accordance with one or more embodiments.

DETAILED DESCRIPTION

An integrated centralized database is disclosed that aggregates all information that is related to, or associated with, any geographic point on the earth, and includes any changes in information over time with respect to that point. A point on the earth is identified by geocoded coordinates, or latitude/longitude. This aggregated information may be related to parcels and buildings associated with that point, insurance claims data, weather data, crime data, demographic data, buildings on that point, reported activities and events, or other related data by time period. The system constantly scans for new information that can be categorized and associated with one or more points on the earth. The centralized database can then be queried to retrieve any and all data related to that point. For example, in one embodiment the simplest query may include providing only a latitude and longitude, and all information related to that point will be retrieved. In other examples, the query may include a request for data associated with locations within a certain proximity to the point. In addition to a single point, queries for information related to multiple points may be performed. In one or more embodiments, the multiple points may be defined by a region, such as by a polygon with vertices identified by a series of geocoded coordinates that include all geographic locations within the polygon area. In other embodiments, a region may be identified by a name or one or more features used to identify a geographic area. In another embodiment, a region defining points may be described as a combination of location description and a point in time. For example, the footprint of the residence building at property address 123 Dry Creek Road, Napa Valley, Calif., on Jul. 4, 1970, or city of Humptulips, Wash., as boundaries were defined on Jan. 31, 1989.

One of the advantages of tracking data associated with a geographic point on the earth is the continuity of location description over time. For example, by using a lot number, a parcel identifier, a county, or city identifier to get information about a specific geographic location, a person is not guaranteed to identify the same geographic location over time. For example, a parcel of land from the 1850s may be the result of the subdivision of a much larger block of land acquired earlier by the state. That parcel may have since been subdivided, and portions of the parcel converted to industrial use with industrial utilities installed and underground storage tanks added. Subsequently, some of the subdivided parcels may have been recombined into new larger parcel and converted into farm use. Several decades later, the larger parcel may have been converted to residential use and subdivided for individual family homes. In this example, it would be difficult to research exactly what happened on the land over the last several hundred years because parcel descriptions of the land were constantly changing. However, each individual geographic point on the earth has a specific history of the parcel associated with it, for example its change of zoning status, which parcels it fell within, who owned it, any permitted improvement, insurance coverage and claims, to whom it was bought and sold, and so on. Therefore, by associating information with one or more geocoded locations on earth, information can be accurately obtained concerning a particular geographic area over any time period.

FIG. **1** is a block diagram **400** which describes an embodiment of an environment in which an integrated centralized property database **102** (which may be referred to at portions herein as "integrated database **102**") is used. The integrated database **102** receives its data from a variety of different data sources **116**, which may include data accessible from the Internet, data accessible from a government, insurance company or any third-party database, and the like. Data provided from the data sources **116** includes a variety of types of data that is, or can be, associated with a particular location or point on Earth.

Types of Data

A wide range of data may be associated with a particular geographic point on the earth, including but not limited to legal data, property characteristic data, transactional data, environmental data, demographic data, and event data.

Examples of legal data include, but are not limited to, deeds or chains of title that include legal descriptions; boundary descriptions; subdivision information, including parcel changes; tax information on the associated parcel; and liens, mortgages, or other encumbrances ever placed or removed. It may also include government records from the

city, county, state, or national levels, pertaining to any real or personal property associated with that point.

In some embodiments, legal data may include transactional data such as purchase, sale, leasing and/or rental agreements including rental contracts, securitization, encumbrance, or other related legal documents, and other documented changes concerning the point that affects ownership or ownership rights. For example, this may include rights involving the point such as mineral rights, water rights, and other land-related rights, as well as transactions regarding buildings or other improvements associated with the point. In these embodiments, the data associated with the point can be used to identify previous owners, previous tenants, and the terms and extent of their holdings.

Legal data may also include insurance contract data that describes, for a particular point, any policy ever written associated with that point, the current policies that are in force, the rates and terms of such policies, any claims made against the policies, and the final outcome of the claim. This data may also include risk management analysis, performed by insurance carriers that did not result in the issuance of any policies. In addition, this information may include photos, tax records, other public records, and property value assessments.

In some embodiments, property characteristic data may be divided into real property and improvements. Real property characteristic data may include elevation, ground slope, soil conditions such as farmland, rocky, marsh, stream, lake, forest, meadow, undeveloped land, paved land, or other. Property characteristic data may also include designations such as floodplain, high risk hail area, or tornado susceptible area.

Improvements characteristic data may include descriptions of one or more buildings on that point; utilities such as water, sewer, electricity or gas running under, though, or over that point; building permits issued or denied, blueprints, on-site photos, videos, inspections, and stop-work and other notices. It may include terrain information such as fill added. In addition, land information associated with the point, but not directly on the point, may include power pole locations, hydrant locations, high-voltage transmission line placement, erosion effects, and vegetation changes. Also, features associated below the point may also be included such as caves, water reserves, mineral deposits, oil reserves or natural gas reserves. Improvement characteristics data may also include analysis in condition data for structures related to the point. For example, reports showing building conditions, such as type of building, square footage, type of materials used in construction, current condition of aspects of the property such as exterior wall conditions, roof conditions and associated roof reports, the results of on-site inspections and analysis, etc. Also included may be construction dates, remodeled dates and demolition dates for buildings, including blueprints and utilities maps for the buildings. In addition to written information, image, video, audio and other methods of capturing information associated with the point may also be stored. For example, aerial images of the property and buildings on the property may be included that come from satellite images, overhead flights, or images captured by property owners, contractors, or service providers, or pictures from other sources, such as recreational photos, that can be associated with that point.

Environmental data may also be associated with the point. For example, standard weather data such as temperature, pressure, precipitation, and the like may be included, along with meteorological data describing major weather events such as tornadoes, hailstorms, lightning, hurricanes, snowstorms, heat waves, and the like that have an impact on the value of the property associated with the point. This data may also include forecasted data, officially reported data, and actual measured data describing the event and its effects. Other examples of events may include earthquakes, floods, and fires that have occurred on the point, or near enough to affect the point.

Other data regarding demographic information, or social data, may be associated with a particular point. For example, average income, education, number of children, crime rates, quality of life measures, school district ratings, unemployment data, weather data, political affiliation data and the like. In addition, consumer and/or business purchase data may also be aggregated and associated with particular points on the earth. For example, the number and type of new car purchases associated with registered vehicle owners having an address listed for that point or within a particular radius of a point. More detailed events may be associated with the property, for example, the contents and date of filed police reports for property associated with the point, specific crime data for criminal record history of people within a region of the point, time and content of any 911 calls or other emergency contacts made from an area associated with the point, and so on.

There are many sources of data associated with a particular address of an activity, an individual, a license, a policy, or other issues. For example, when a person files for any type of license, whether driver's license, fishing license, marriage license, or any approval issued by a state, city, or county, they are frequently required to provide the address of their current residence. This address is a geographic location. At the time that the license is applied for, the address will be a geographic location of a polygon of a certain size. It may be a few thousand square feet, a few acres, or any one of a number of different sizes and shapes. At a different point in time, that same address may represent a different sized or shaped polygon. Accordingly, the address and the date for that address are interesting data points for storage. Additional information is the particular type of license that was requested for that address. For example, a particular address may have one, two, or dozens of people listing that as their address for a type of license or registration. For example, multiple people may list the same address for their driver's license, voter registration, boat registration, and the like. Knowing the number of people that have listed the same address for their voter registration or, similarly, an address associated with a geographic location that is within the same polygon as another address has particular benefits.

Other events that may be of particular interest are whether the address was listed in any form for a purchase of a firearm, a person selling a firearm, or a person requesting a concealed carry permit for a firearm. The address of a person requesting to purchase certain materials, such as chemical compositions, garden fertilizer, and in what quantities and other data may also be of interest.

Many private transactions, not associated with a government entity or license request, are also frequently associated with a particular address. This may include a request for a credit card; joining a private organization such as the Lion's Club, the Boy Scouts of America, the Girl Scouts of America; applying for a private service, such as a telephone installation, having a plumber come visit, having a visit from an electrician, the pumping of a septic tank, installation of a property improvement such as a hot tub, a swimming pool, cutting of trees, the buying or selling of livestock, or any one of a number of transactions which are private as between two individuals or an individual and a company, but in

which one of the individuals provides an address that is associated with that particular transaction. This address may then be loaded into any one of a number of available databases, such as into the person's Facebook account, a log record of visits made by a plumbing company, an auctions house listing of the address of people who bought and sold goods, livestock or other items at the auction, or the like. These are instances in which the transactions were private between individuals and no record was made in any government database maintained at a city, county, state, or federal level. However, the database may have become available based on the voluntary listing by one or more of the people involved in the transaction, such as inputting to the business storage records and the then the business records being made available on the Internet, posting to a social media website, such as Facebook, Twitter, Linked In or the like.

In addition, there are two types of data which may be associated with a particular address. One is an event originating from that address and another is an event about that address. For example, a neighbor may call in a complaint about a different property being an eyesore or violating local zoning laws. In that instance, there are two addresses associated with the particular event, the first address is the address of the person who issued the complaint and the second is the address about which the complaint was made. Thus, for a single event, namely a complaint regarding the maintaining of property, there will be two geographic locations associated with that event, one of which will be the geographic location where data originated and another the geographic location of where the event itself is taking place. Thus, for each event there may be multiple addresses associated with that event and each address will have a data field that indicates whether the event occurred at that address or whether the reporting of that event came from that address or some other particular way that the address is associated with the particular event.

Other sources of information between private individuals may include magazine subscription, mailing lists, donations to local causes, donations to charity, or other activities in which one of the parties provides the address at which they will be receiving goods being shipped by another party where the goods are being purchased from Amazon, Barnes & Noble, or any other many thousands of Internet shopping sites which are available.

The data may take a number of different forms including, but not limited to numbers, text, images, graphics, and audio and video. The data may also be in a form readable by a computer or other device, such as a binary form or encrypted form, or in multiple forms that may be combined in one or more ways. In addition, the data may contain references to locations of other data sources. This may include links, such as hypertext links to areas on the internet, or references to other systems, for example executable modules or other computer implemented algorithms, that return data related to the point on the earth.

This data described above represents a very small subset of all possible data that could be associated with a particular point on the earth. The data provided from data sources **116** may include any such type of data that could be associated with a particular point on the earth, including the types described above, and may be provided from data sources **116** including those described above.

Collecting Data

Data related to a point on the earth is collected from data sources **116** in a variety of ways. In some embodiments, web crawlers **108** are used to search for data or updates to data in a systematic way throughout the Internet to search for data concerning regions that are associated with particular points on the earth. For example, given a particular point and a particular time, the web crawler **108** will identify and collect the information, such as described above, on the parcels, neighborhoods, cities, counties, and state with which the point is associated.

In addition, image crawlers **110** may be used to systematically examine images, accessible via the internet or other sources, and image metadata associated with each image. Metadata may include, for example, an image title, image description, or latitude/longitude at which the picture was taken. For example, the image crawler **110** may find an image taken at a wedding held in a field next to a property where the background of the image includes the property. The metadata in the picture may include the latitude and longitude of the camera location, the time the image was captured, and the cardinal direction the camera was pointing. From this information, the image crawler **110** can determine that the image is relevant to the point of the earth if, for example, the image shows part of a building at the point. Additionally, or alternatively, the image may be relevant simply because it depicts a scene at the point of the earth at a particular point in time. The image crawler **110** would then add this image and its metadata information (e.g., before or after further processing) to the integrated centralized property database **102**.

Further, data may be collected from data sources **116** via data feeds **112**. Data feeds **112** may include feeds of data from any type of data source **116**. For example, data feeds **112** may include subscription-based data (which may be provided for free, or for a charge) that is periodically updated and pushed to the integrated centralized property database **102**. Examples of data feeds **112** may include, for example, a weather data feed that provides a continuous or periodic stream of data relating to weather conditions or forecasts. Similarly, data feeds **112** may include a police or other government service feed, which may provide a feed of data relating to criminal activity, civil complaints, road conditions and the like that may be associated with one or more geographic locations. Data feeds **112** may further include feeds from emergency or alerting services, such as Amber Alerts, weather event warning systems (e.g., a data feed providing warnings for hurricanes, tsunamis, tornados, earthquakes, snowstorms, or the like).

Additionally, data feeds **112** may include publicly- or privately-accessible social network data (e.g., Twitter, Facebook, Google+, Instagram, Picasa, etc.). Such social network data commonly includes user-uploaded images, text, documents and the like which may be associated with a particular point on the earth. As such, social network data may contain relevant data which may be provided as part of a data feed, or alternatively, which may be discovered by a web crawler **108** and/or image crawler **110**.

Data feeds **112** may further include feeds of data relating to changes in status of property, such as, for example, data indicating a sale of a home, data indicating a rezoning or change in zoning for a particular geographic location or the like.

As discussed above, information may be collected from a number of data sources **116**. These may include, for example, the public Internet, private/restricted Internet sites such as those requiring a subscription, and governmental sites. In addition, public and private data aggregation sources may also be used as data sources **116**, for example those having real estate and demographic information such as Zillow, Trulia, Realtor.com, and others. In some embodi-

ments, data, such as property characteristic data, can be purchased from other data sources **116** and included in systems using the integrated centralized property database **102**, either electronically or acquired in print and scanned in. Through these or other embodiments, data relating to any particular point of property on earth may be mined anywhere in the world.

Processing and Storing Data

The collected data may be aggregated, centralized, stored and accessed in a number of different ways in various embodiments. Processing of incoming data may be accomplished by a processor **106**. In one embodiment, the integrated database **102** may consist of one database with multiple data sets which may span multiple physical machines and physical disk drives, where all information collected about all points on the earth is replicated and stored. This way, all of the known and available information as of the most current time of receipt (e.g., from web crawler **108**, image crawler **110** and/or data feeds **112**) may be immediately retrieved from the database and presented to the user.

In another embodiment, the integrated database **102** may include a combination of both replicated information and reference links to data sources outside of the database, such as to a site on the Internet. An advantage of this structure is that a cached version of the data will be immediately available from the integrated centralized database **102**, and reference links will point directly to the original data source to ensure that the latest version of the data is available.

Referring to FIG. **2**, in one or more embodiments, each data item **410** has at least three individual attributes: information **130**, location **132** and date **134**. Information **130** includes of an actual data item and/or a reference to a data item stored at a location outside of the integrated database **102** where the information may be retrieved. For example, the reference to data may be a link or reference to a price at which a property associated with a particular point on the earth has ever been sold, all taxes ever levied on the property, all insurance policies underwritten for the property, and so on. It may also be the data itself, such as the type of license obtained, item purchased, etc.

The location **132** attribute refers to the locations on the earth to which the information refers or is associated with. This location information may be represented as a geocoded location, for example latitude/longitude. However, the location **132** may be a property street address, a parcel identifier, a ZIP code, a city, county, or state designation. In some cases, it may be a region identifier such as a climate zone, a marketing area, or a bounded area of a particular event such as a hailstorm or a fire. In addition, the location **132** may correspond to a demographic or socio-economic region, such as a region within a state where the average number of people in a household is 2.5, or a region where there is at least one person within the household over the age of 65, or where average income is above $50,000.

The location **132** attribute, in one embodiment, includes at least two fields: the first field indicates the location itself, as previously described, and the second field indicates the relationship of the location to the data. In the first field, the location itself may be described and stored in multiple formats. For example, in addition to being a parcel identifier or a property street address, it can also include the longitude and latitude of the boundaries of a polygon which encloses that particular parcel or property address. There are a number of other overlapping ways in which a geographic point can be defined. The relationship to the data or event will provide an indication of how that particular location is related to the actual information **130** itself. The location may be indicated as where the event occurred or that the information is a description of that particular address, in which case, the location **132** field attribute would refer to itself. Alternatively, this field of the location **132** attribute may refer to the source of the data which is in the information **130**. For example, if a 911 call is made this is a single event, a single information; however, two data records can be obtained, one having the location from which the call originated and the field for the location **132** would be marked as the source of the data, and a separate record having the same event information **130** but whose location **132** has the field attribute that the information applies to that particular location, namely to itself. It is, thus, possible that a single piece of information **130**, whether it is an event or data, may have multiple items stored because it is associated with multiple addresses or locations **132**. Of course, the same location **132** may have multiple events associated with that address, as will be apparent since a single address will likely have a home owner's insurance policy, driver's license, voter registrations, mailing lists, etc., all having the same location **132**, but having different information **130** associated with that location **132**.

In some embodiments, the date **134** attribute identifies the date and time at which the data item is or was relevant. The date **134** attribute can correspond to a specific point in time, to a specific range of time, or it could be associated with multiple time ranges. For example, the tax records associated with a particular parcel of land, which contains a point on the earth of interest, may be associated with particular years, or a range of months between land assessment updates.

The processor **106** may generate the data items **410** based on data received from the data sources **116**. For example, the processor **106** may receive an image of a particular point on earth from an image crawler **110**. The processor **106** may analyze metadata received with the image to determine location information (such as, for example, latitude and longitude) associated with the image, as well as to determine a date that the image was taken. The processor **106** may then create a data item **410**, which may have a standard format or structure, including the information **130** (i.e., the image), location **132** and date **134**. This data item **410** may then be stored in the integrated centralized property database **102**.

FIG. **3** is a block diagram **420** illustrating a process for adding geocoding information and category information to a data item **410**, in accordance with one or more embodiments. As shown in FIG. **3**, additional attributes may be associated with the data item **410**, and may be determined by examining other data item **410** attributes. For example, the processor **106** may receive information **130** and categorize **138** the information into one or more categories **146** for easier grouping. The category **146** information may be appended to or otherwise associated with the data item **410** and stored in the integrated centralized property database **102**. Example categories **146** include, but are not limited to, insurance underwriting, insurance claims, tax information, property characteristics, crime, demographics, weather events, and so on.

The data item **410** may further be analyzed by the processor **106** to determine relevant geocoding **140**. In some embodiments, the location **132** attribute and the date **134** attribute may be combined to produce one or more geocoded locations identified by latitude/longitude. In this way, information **130** associated with a named location **132** that represents different areas at different dates can be properly identified with specific points on the earth. For example, tax

information associated with the address 199 Dry Creek Road, Napa, Calif. 94558 in 1968 may have referred to a 10-acre parcel of farm land, where the same address today may refer to a single family home that was subdivided from the 10 acres in 1989. In this example, the date **1968** together with the address would identify a range of geocoded locations to which 1968 tax information would be relevant, which is different than the geocoded locations associated with any current tax information. Therefore, in these embodiments, an updated data item **410** may include—in addition to information **130**, location identifier **132** and date **134**—a category **146** and one or more (e.g., a range of) geocoded coordinates **150**.

FIG. **4** is a flowchart illustrating a process **430** for determining relevant geocoding information. At block **152**, the process includes receiving a location description **132** of a data item **410**. The location description **132** of the data item **410** may be received by the processor **106**, and may be received from a web crawler **108**, image crawler **110**, data feeds **112** and/or update sources **114**, any of which may have retrieved the location description **132** from data sources **116**. As an example, the received location description **132** may be a neighborhood, a parcel, a lot, an address, or other such non-geocoded location descriptions.

At block **154**, the processor **106** receives the date **134** associated with the location description **132**. The date **134** may be received by the processor **106** from the same source (i.e., the web crawler **108**, image crawler **110**, data feeds **112**, and/or update sources **114**) that provided the location description **132**. Alternatively, the date **134** may be determined by the processor **106**, for example, by analyzing metadata, image analysis, text analysis, or the like.

At block **156**, the processor **106** determines the geographical boundaries of the location description **132** at the date **134**. The geographical boundaries, in at least some retrieved data items, may be absent from the location description **132** itself (e.g., the location description **132** may identify a neighborhood, parcel, lot, address, or the like). In such a case, the processor **106** may determine the geographical boundaries of the location at the date received at **154** utilizing various techniques. One such technique, for example, may involve comparing the location information with location information which may be stored in the integrated database **102**, or in any other accessible database. For example, if the received location description **132** is a particular neighborhood in the city of Seattle, at block **156**, the processor **106** may reference a Seattle neighborhood database (which may be a publicly-accessible database) to determine the streets or blocks which define a boundary for that neighborhood at the date received at block **154**. Because property boundaries often change over time (e.g., neighborhoods, lots, census-defined areas, voting districts and the like), determining the geographical boundaries of the location description at the date, at block **156**, enables accurate associations between the location description **132** and the date **134**.

At block **158**, the processor **106** converts the geographical boundaries determined at block **156** into ranges of associated geocoded coordinates (i.e., latitude and longitude). This may be accomplished, in some embodiments, by referencing one or more maps containing geocoded coordinates. For example, a city map or a street map may be superimposed onto a geocoding map containing latitude and longitude coordinates, and the processor **106** may thus determine the geocoded coordinates which correspond to the boundaries (e.g., street boundaries, parcel boundaries, etc.) which were determined at block **156**.

At block **160**, the determined geocoded coordinates associated with the location description **132** and date **134** are added to the data item **410**. The updated data item **410** may thus be stored in the integrated database **102**. FIG. **5** is a flowchart illustrating a process **440** for associating one or more categories **146** to a data item **410**. At block **170**, the process includes receiving a data item **410**. The data item **410** may be received by the processor **106**, and may be received from a web crawler **108**, image crawler **110**, data feeds **112** and/or update sources **114**, any of which may have retrieved the data item **410** from data sources **116**.

At block **172**, the processor **106** analyzes the data item **410** to determine one or more applicable categories **146** to which the data item **410** pertains or should be associated with. The processor **106** may employ various techniques for analyzing and determining applicable categories. For example, the processor **106** may analyze the information **130** and/or location description **132** included in the received data item **410**, which may include, for example, textual information describing the location. The processor **106** may utilize any textual or other information processing techniques, including for example heuristic processes, to determine one or more categories **146** relevant to the data item **410**. The processor **106** may access a categories database, which may be included in or otherwise accessible to the integrated database **102**, to determine one or more categories **146** relevant to the data item **410**. Examples of such categories include, but are not limited to, insurance underwriting, insurance claims, tax information, property characteristics, crime, demographics, weather events, and so on.

At block **174**, the applicable categories **146** are added to the data item **410**. The updated data item **410** may thus be stored in the integrated database **102**, along with the associated category **146** information.

In some embodiments, "location information" refers not only to a specific latitude and longitude, but additionally includes vertical or Z-axis information (e.g., indicating a height above or a depth below the surface of the earth).

User Interface/Types of Queries

Referring again to the block diagram **400** of FIG. **1**, property information contained in the integrated database **102** may be accessed by one or more users via a graphical user interface **120**.

Integrated database **102** includes data items having particular location information (as discussed above), such that each of the data items are associated with a particular point on the earth, effectively making up a "globe" **104**, or map of locations, with each information item being linked to one or more particular locations on the globe **104** or map.

Queries **118** may be received by the integrated database **102** from one or more user computer systems. The queries **118** may be provided by users through the user interface **120**, and may be provided in a variety of forms. For example, a query **118** may be provided by inputting location information (e.g., latitude/longitude) and querying for all information associated with that particular point on the earth. Alternatively, the query **118** may specify particular types of information associated with the particular point on the earth to be returned, such as, for example, only insurance-related information, property zoning information, weather-related information, and so on.

The query **118** may specify a property location of interest by directly inputting location information, or by selecting a particular point on a map provided by the user interface **120** (e.g., the "X" shown in FIG. **1**), or by selecting an area within the map (e.g., the area shown within the dotted lines in FIG. **1**). An area within the map may be selected by, for

example, a drawing tool provided through the user interface **120** which allows a user to draw polygons or various other shapes. Further, queries **118** may include Z-axis information (i.e., location information in a vertical direction). For example, a user may provide a query **118** to the integrated database **102** that specifies a particular latitude and longitude, and further specifies a depth or height of 10 meters to 100 meters. In such a case, the integrated database **102** will display all matching information to the user via the user interface **120**.

The geographic location of a particular point can be described a number of ways. Generally, a latitude and longitude are more than sufficient to specify the particular location of an item. Latitudes and longitudes can have a number of decimal points specified that provide information regarding degrees, minutes, seconds, and subparts of seconds, as well as decimal degrees with a number points. The number of decimal points or subparts of seconds that a latitude or longitude specifies will reduce the geographic area of the point under consideration. For example, a latitude that is specified exactly in degrees, minutes, and seconds will be a fairly large area of land. For example, one minute equals the width of somewhat less than a mile, approximately 0.91 miles and one second equals approximately a width of 80 feet. A measure of latitude and longitude in seconds thus covers a point on the earth that is about 640 square feet. If a more precise location is to be identified, which is frequently the case, the latitude and longitude can be specified in fractions of a second or in the decimal format which can specify locations of particular points in the range of one square foot, a quarter of a square foot, or smaller.

In such a reference plane, latitude is generally considered an X data point and longitude a Y data point. Thus, with longitude and latitude acting as an X and Y reference grid, respectively, any particular location on the surface of the earth can be defined with a high degree of accuracy. For some locations, and some events, it may be desired to also provide a height or depth reference, which will be referred to herein as the Z axis. A plus Z represents a height above the surface of the earth and a minus Z represents a depth below the surface of the earth. Thus, the third floor of a building may have the same X and Y coordinates as the second and first floors of that building, but would have a different Z reference. Given the large number of apartment complexes, high-rise office buildings, and other events that may happen at various heights above the surface of the earth, the option to include a Z axis height provides significant benefits and a further ability to define the exact location of a particular event or data. Some events may also be a negative Z, such as may occur in mine shafts, the bottom of a lake, or some other location which is below the local surface of the earth at that point.

The references as provided herein to latitude and longitude refer to the surface of the earth at that particular geographic location. Thus, a longitude and latitude geographic location in with a high altitude, such as Denver or Breckenridge, would not include within it a Z axis measure if it were referring to the land that was at the surface of the earth at that location. Rather, the Z axis is for including a reference to an event or data that is above or below the local surface of the geographic earth surface feature at that location which may be either a ground or water, such as a lake, river, stream, or ocean.

In response to queries **118**, the integrated database **102** may provide the relevant data overlaid on a map in the user interface **120**. The data may include, for example, any data items **410** stored in the integrated database **102** having a location corresponding to a location provided by the query **118**. Further, the user interface **120** may provide users an option to display only a particular type of data items **410**, based on category **146** or the like. For example, a user of the user interface **120** may select to display only crime data, demographic data, school data, insurance data or so on.

The user interface **120** may further include a time scale **122**, which allows a user to select (e.g., by moving a slider **122***a*) a particular time or range of times of interest. The time scale **122** may allow users to query **118** the integrated database **102** for information associated with particular points on the earth at any time, including decades, years, months, weeks, etc.

In one or more embodiments, users may query the system by identifying one or more points on the earth to receive information associated with those points, or may query the system by identifying information parameters to receive points on the earth associated with that information. Example queries include: do an address and a geolocation coordinate refer to the same parcel or spot? What demographics are associated with a point on the earth? What is the entire property history of a particular point? What is the current tax information for the parcel associated with this point? What building or construction permits have ever been issued for any parcel associated with this point of land? Who has ever held title to the land? Who has ever leased the land? In what areas of a county is the crime rate above 5%?

The system would also be valuable for insurance carriers. For example, for underwriters, what is the insurance claim history for properties at this location? Is there evidence of a land depression filled up around this location? Have there ever been floods at this location? What is the grade of the earth at this point? Have oil tanks ever been buried close to this location, or have oil lines fed this location at any time in the past? Do structures near this location exhibit evidence of moss buildup or other evidence of lack of upkeep?

In one or more embodiments, the data aggregation system may be queried using a structured query language, or queries **118** may be generated through the graphical user interface **120**.

Computing System

FIG. **6** is a block diagram **450** showing a computing system **600** for managing and providing access to the integrated centralized property database **102**, according to one or more embodiments.

The computing system **600** may include one or more distributed computing systems. In addition, each block shown may represent one or more such blocks as appropriate to a specific embodiment, or may be combined with other blocks. Moreover, in one example embodiment, the various components of a data aggregation system **614** may physically reside on one or more machines, which use standard inter-process communication mechanisms (e.g., TCP/IP) to communicate with each other. Further, the data aggregation system **614** may be implemented in software, hardware, firmware, or in any combination thereof to achieve the capabilities described herein.

In the embodiment shown, the computing system **600** includes a computer memory ("memory") **602**, a display **604**, one or more Central Processing Units ("CPU") **606**, Input/Output devices **608** (e.g., keyboard, mouse, joystick, track pad, CRT or LCD display, and the like), other computer-readable media **610**, and network connections **612**. A data aggregation system **614** is shown residing in the memory **602**. In other embodiments, some portion of the contents or some or all of the components of the data aggregation system **614** may be stored on and/or transmitted

over the other computer-readable media **610**. The components of the data aggregation system **614** preferably execute on one or more CPUs **606** and generate data items **410**, determine relevant geocoding **140**, and categorize data **138**, as described herein. Other code or programs **616** (e.g., a Web server, a database management system, and the like) and potentially other data repositories, such as data repository **618** (which may include, for example, a globe **104** or map including associated geocoding information), may also reside in the memory **602** or may otherwise be accessible to the data aggregation system **614**, and preferably execute on one or more CPUs **606**. All of the components in FIG. **6** may not be required for each implementation. Some inputs to the data aggregation system **614** may be automatically generated and/or provided (e.g., inputs from web crawlers **108**, image crawlers **110**, data feeds **112**, etc.), but other inputs may be entered manually to supplement data acquired through automated means.

As shown in FIG. **6**, the data aggregation system **614** may include a data acquisition engine **620**; a data management engine **622**; a geocoding engine **624** and categorization engine **626** within, or as part of, the data management engine **622**; an interface engine **628**; and an integrated centralized property database **102**.

The data acquisition engine **620** performs at least some of the functions described herein, with respect to the processes described herein. In particular, the data acquisition engine **620** interacts with the data sources **116** to obtain data items **410**, or information associated with particular points on the earth, and provides such information to the data management engine **622** for further processing.

The data management engine **622** performs at least some of the functions described herein. In particular, the data management engine **622** receives data items **410** obtained by the data acquisition engine **620**, adds category information to the data item **410** (e.g., as shown and described with respect to FIG. **3**, herein) by the categorization engine **626**, and determines and adds relevant geocoding (e.g., as shown and described with respect to FIG. **4**, herein) by the geocoding engine **624**.

The data management engine **622**, after processing obtained data items **410** as described herein, provides the data items to the integrated centralized property database **102** for storage and retrieval in response to user queries **118**.

In addition, the data aggregation system **614** interacts via a communications network **632** with data source computing systems **634** and/or one or more user computing systems **638**. Communications network **632** may utilize one or more protocols to communicate via one or more physical networks, including local area networks, wireless networks, dedicated lines, intranets, the Internet, and the like.

User computing systems **638** may be computer systems utilized by any user of the data aggregation system **614**, including, for example, insurance companies, real estate professionals, builders, parties interested in conducting property transactions, and so on.

The data acquisition engine **620** may obtain data items **410**, for example, through communication via communications network **632** with data source computing systems **634**. Users may utilize one or more user computing systems **638** to access the data aggregation system **614** and query the integrated centralized property database **102**, for example, via the user interface **120**.

The various embodiments described above can be combined to provide further embodiments. These and other changes can be made to the embodiments in light of the above-detailed description. In general, in the following claims, the terms used should not be construed to limit the claims to the specific embodiments disclosed in the specification and the claims, but should be construed to include all possible embodiments along with the full scope of equivalents to which such claims are entitled. Accordingly, the claims are not limited by the disclosure.

The invention claimed is:

1. A method, comprising:

storing a plurality of data items in a data aggregation system, each of the plurality of data items being associated with one or more geographic location identifiers of a particular geographic point on earth, wherein at least a portion of the plurality of data items stored in the data aggregation system are further associated with one or more time identifiers including one or more time or time periods, indicative of a time history of an associated data item regarding the associated geographic point on earth;

receiving, by at least one processor, a query regarding a geographic location and including time information;

retrieving, from the data aggregation system, data items having associated geographic location identifiers matching the received geographic location and having associated time identifiers matching the received time information; and

outputting the retrieved data items.

2. The method of claim **1**, wherein the one or more geographic location identifiers include latitude and longitude coordinates of a surface of the earth.

3. The method of claim **2**, wherein the one or more geographic location identifiers further include at least one of a height above or a depth below the surface of the earth.

4. The method of claim **1**, wherein the received geographic location includes a region on the earth.

5. The method of claim **4**, wherein the region on the earth is identified by multiple geocoded locations, the multiple geocoded locations described in at least latitude and longitude coordinates.

6. The method of claim **1**, wherein the time information of the query includes one or more time periods.

7. The method of claim **1**, wherein the one or more location identifiers include content external to the data aggregation system.

8. The method of claim **1**, wherein the stored data items include at least one of: tax data, building code data, weather data, insurance data, crime data, survey data, school data, demographic data and property data.

9. A system, comprising:

a computer processor;

a memory coupled to the processor; and

an integrated centralized property database, the processor being configured to:

receive from a user computer a query including a geographic location identifier, the geographic location identifier including one of a geocoded location and multiple geocoded locations identifying a polygon,

receive from the user computer a time period identifier including one or more time or time periods, indicative of a time history of an associated data item regarding the associated geographic point on earth,

retrieve from the integrated centralized property database location data, the location data including data associated with the geographic location identifier of a geographic location on the earth, and associated with the received time period identifier, and

provide the retrieved location data to the user computer via a graphical user interface.

10. The system of claim **9**, the processor further configured to:

retrieve parcel information from the integrated centralized property database;

compare the retrieved parcel information with the location data to determine parcels associated with the geographic location identifier; and

output the parcels associated with the geographic location identifier.

11. The system of claim **10**, the processor further configured to:

retrieve insurance policy information from the integrated centralized property database;

compare the retrieved insurance policy information with the parcels associated with the geographic location identifier to determine the insurance policies associated with the geographic location identifier; and

output the insurance policies associated with the geographic location identifier.

12. A system, comprising:

an integrated centralized property database stored on computer-readable storage media, the integrated centralized property database including a plurality of data items, each of the plurality of data items being associated with one or more geographic location identifiers indicating a particular geographic point on earth, and at least a portion of the plurality of data items further being associated with one or more time identifiers including one or more time or time periods, indicative of a time history of an associated data item regarding the associated geographic point on earth;

at least one computer processor communicatively coupled with the integrated centralized property database, the at least one computer processor configured to:

receive, from a user computer system, a query of a geographic location and time information indicative of the time history of an associated data item regarding the associated geographic point on earth;

retrieve, from the integrated centralized property database, data items having associated geographic location identifiers matching the received geographic location and having associated time identifiers matching the received time information; and

provide the retrieved data items to the user computer system via a graphical user interface.

13. The system of claim **12**, wherein the one or more geographic location identifiers include latitude and longitude coordinates.

14. The system of claim **13**, wherein the one or more geographic location identifiers further include Z-axis coordinates, wherein the Z-axis coordinates are indicative of location above or below a surface of the earth.

15. The system of claim **12**, wherein the time identifier includes one or more time periods.

16. The system of claim **12**, wherein the one or more geographic location identifiers are associated with content external to the system.

17. The system of claim **12**, wherein the stored data items include at least one of: tax data, building code data, weather data, insurance data, crime data, survey data, school data, demographic data and property data.

18. A system, comprising:

means for storing a plurality of data items in a data aggregation system, each of the plurality of data items being associated with one or more geographic location identifiers indicating a particular geographic point on earth, and at least a portion of the plurality of data items further being associated with one or more time identifiers including one or more time or time periods, indicative of a time history of an associated data item regarding the associated geographic point on earth;

means for receiving a query regarding a geographic location and time information indicative of the time history of an associated data item regarding the associated geographic point on earth;

means for retrieving data items having associated geographic location identifiers matching the received geographic location and having associated time identifiers matching the received time information; and

means for outputting the retrieved data items.

* * * * *