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McKinnon et al.

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(54) **WIDE AREA AUGMENTED REALITY
LOCATION-BASED SERVICES**

(52) **U.S. Cl.**

CPC **G06F 16/5866** (2019.01); **G06F 16/29**
(2019.01); **G06F 16/50** (2019.01);
(Continued)

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(58) **Field of Classification Search**

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See application file for complete search history.

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(56) **References Cited**

U.S. PATENT DOCUMENTS

5,625,765 A 4/1997 Ellenby et al.
5,682,332 A 10/1997 Ellenby et al.
(Continued)

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FOREIGN PATENT DOCUMENTS

EP 1 012 725 6/2000
EP 1 246 080 A2 10/2002
(Continued)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
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This patent is subject to a terminal dis-
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OTHER PUBLICATIONS

International Search Report and Written Opinion issued in Interna-
tional Application No. PCT/US2012/032204 dated Oct. 29, 2012.
(Continued)

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Primary Examiner — Charles Tseng

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Related U.S. Application Data

(63) Continuation of application No. 15/794,993, filed on
Oct. 26, 2017, now Pat. No. 10,140,317, which is a
(Continued)

(57) **ABSTRACT**

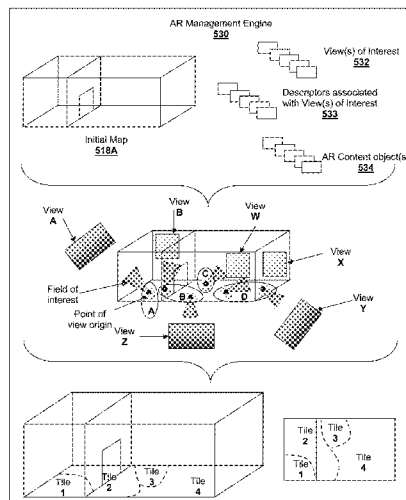
Apparatus, methods and systems of providing AR content
are disclosed. Embodiments of the inventive subject matter
can obtain an initial map of an area, derive views of interest,
obtain AR content objects associated with the views of
interest, establish experience clusters and generate a tile map
tessellated based on the experience clusters. A user device
could be configured to obtain and instantiate at least some of
the AR content objects based on at least one of a location and
a recognition.

(51) **Int. Cl.**

G09G 5/00 (2006.01)
G06F 16/58 (2019.01)

(Continued)

39 Claims, 6 Drawing Sheets



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continuation of application No. 15/406,146, filed on Jan. 13, 2017, now Pat. No. 9,817,848, which is a continuation of application No. 14/517,728, filed on Oct. 17, 2014, now Pat. No. 9,582,516.

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(51) **Int. Cl.**

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(52) **U.S. Cl.**

CPC **G06F 16/58** (2019.01); **G06F 16/5854** (2019.01); **G06F 16/9535** (2019.01); **G06T 15/20** (2013.01); **G06T 19/003** (2013.01); **G06T 19/006** (2013.01); **H05K 999/99** (2013.01); **G06T 2219/024** (2013.01)

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,742,521 A 4/1998 Ellenby et al.
 5,815,411 A 9/1998 Ellenby et al.
 5,991,827 A 11/1999 Ellenby et al.
 6,031,545 A 2/2000 Ellenby et al.
 6,037,936 A 3/2000 Ellenby et al.
 6,064,398 A 5/2000 Ellenby et al.
 6,064,749 A 5/2000 Hirota et al.
 6,098,118 A 8/2000 Ellenby et al.
 6,130,673 A 10/2000 Pulli et al.
 6,173,239 B1 1/2001 Ellenby
 6,278,461 B1 8/2001 Ellenby et al.
 6,307,556 B1 10/2001 Ellenby et al.
 6,396,475 B1 5/2002 Ellenby et al.
 6,414,696 B1 7/2002 Ellenby et al.
 6,522,292 B1 2/2003 Ellenby et al.
 6,535,210 B1 3/2003 Ellenby et al.
 6,690,370 B2 2/2004 Ellenby et al.
 6,804,726 B1 10/2004 Ellenby et al.
 7,016,532 B2 3/2006 Boncyk et al.
 7,031,875 B2 4/2006 Ellenby et al.
 7,245,273 B2 7/2007 Eberl et al.
 7,301,536 B2 11/2007 Ellenby et al.
 7,477,780 B2 1/2009 Boncyk et al.
 7,529,639 B2 5/2009 Rasanen et al.
 7,564,469 B2 7/2009 Cohen
 7,565,008 B2 7/2009 Boncyk et al.
 7,641,342 B2 1/2010 Eberl et al.
 7,680,324 B2 3/2010 Boncyk et al.
 7,696,905 B2 4/2010 Ellenby et al.
 7,710,395 B2 5/2010 Rodgers et al.
 7,768,534 B2 8/2010 Pentenrieder et al.
 7,774,180 B2 8/2010 Joussemet et al.
 7,847,699 B2 12/2010 Lee et al.
 7,889,193 B2 2/2011 Platonov et al.
 7,899,915 B2 3/2011 Reisman
 7,904,577 B2 3/2011 Taylor
 7,907,128 B2 3/2011 Bathiche et al.
 7,908,462 B2 3/2011 Sung
 7,916,138 B2 3/2011 John et al.
 8,218,873 B2 7/2012 Boncyk et al.
 8,224,077 B2 7/2012 Boncyk et al.
 8,224,078 B2 7/2012 Boncyk et al.
 8,291,346 B2 10/2012 Kerr et al.
 8,315,432 B2 11/2012 Lefevre et al.
 8,321,527 B2 11/2012 Martin et al.

8,502,835 B1 8/2013 Meehan
 8,519,844 B2 8/2013 Richey et al.
 8,527,340 B2 9/2013 Fisher et al.
 8,537,113 B2 9/2013 Weising et al.
 8,576,756 B2 11/2013 Ko et al.
 8,605,141 B2 12/2013 Dialameh et al.
 8,606,657 B2 12/2013 Chesnut et al.
 8,633,946 B2 1/2014 Cohen
 8,700,060 B2 4/2014 Huang
 8,711,176 B2 4/2014 Douris et al.
 8,810,598 B2 8/2014 Soon-Shiong
 8,872,851 B2 10/2014 Choubassi et al.
 8,933,841 B2 1/2015 Valace et al.
 8,965,741 B2 2/2015 McCulloch et al.
 9,128,520 B2 9/2015 Geisner et al.
 9,129,644 B2 9/2015 Gay et al.
 9,131,208 B2 9/2015 Jin
 9,167,386 B2 10/2015 Valace et al.
 9,177,381 B2 11/2015 McKinnon
 9,182,815 B2 11/2015 Small et al.
 9,183,560 B2 11/2015 Abelow
 9,230,367 B2 1/2016 Stroila
 9,311,397 B2 4/2016 Meadow et al.
 9,396,589 B2 7/2016 Soon-Shiong
 9,482,528 B2 11/2016 Baker et al.
 9,495,591 B2 11/2016 Visser et al.
 9,536,251 B2 1/2017 Huang et al.
 9,582,516 B2 2/2017 McKinnon et al.
 9,817,848 B2 11/2017 McKinnon et al.
 9,824,501 B2 11/2017 Soon-Shiong
 10,127,733 B2 11/2018 Soon-Shiong
 10,140,317 B2 11/2018 McKinnon et al.
 2002/0163521 A1 11/2002 Ellenby et al.
 2004/0203380 A1 10/2004 Hamdi et al.
 2005/0024501 A1 2/2005 Ellenby et al.
 2005/0208457 A1 9/2005 Fink et al.
 2005/0285878 A1 12/2005 Singh et al.
 2005/0289590 A1 12/2005 Cheok et al.
 2006/0025229 A1 2/2006 Mahajan et al.
 2006/0038833 A1 2/2006 Mallinson et al.
 2006/0047704 A1 3/2006 Gopalakrishnan
 2006/0161379 A1 7/2006 Ellenby et al.
 2006/0190812 A1 8/2006 Ellenby et al.
 2007/0109619 A1 5/2007 Eberl et al.
 2007/0146391 A1 6/2007 Pentenrieder et al.
 2007/0182739 A1 8/2007 Platonov et al.
 2008/0024594 A1 1/2008 Ritchey
 2008/0154538 A1 6/2008 Stathis
 2008/0157946 A1 7/2008 Eberl et al.
 2008/0198159 A1 8/2008 Liu et al.
 2008/0198222 A1 8/2008 Gowda
 2009/0003662 A1 1/2009 Joseph et al.
 2009/0081959 A1 3/2009 Gyorfi et al.
 2009/0102859 A1 4/2009 Athsani et al.
 2009/0167787 A1 7/2009 Bathiche et al.
 2009/0193055 A1 7/2009 Kuberka et al.
 2009/0210486 A1 8/2009 Lim
 2009/0237546 A1 9/2009 Bloebaum et al.
 2009/0271160 A1 10/2009 Copenhagen et al.
 2009/0271715 A1 10/2009 Tumuluri
 2010/0017722 A1 1/2010 Cohen
 2010/0023878 A1 1/2010 Douris et al.
 2010/0045933 A1 2/2010 Eberl et al.
 2010/0113157 A1 5/2010 Chin et al.
 2010/0188638 A1 7/2010 Eberl et al.
 2010/0189309 A1 7/2010 Rouzes et al.
 2010/0208033 A1 8/2010 Edge et al.
 2010/0217855 A1 8/2010 Przybysz et al.
 2010/0246969 A1 9/2010 Winder et al.
 2010/0257252 A1 10/2010 Dougherty et al.
 2010/0287485 A1 11/2010 Bertolami et al.
 2010/0315418 A1 12/2010 Woo
 2010/0321540 A1 12/2010 Woo et al.
 2010/0325154 A1 12/2010 Schloter et al.
 2011/0038634 A1 2/2011 DeCusatis et al.
 2011/0221771 A1 9/2011 Cramer et al.
 2011/0279445 A1 11/2011 Murphy et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

2012/0105475 A1 5/2012 Tseng et al.
 2012/0113141 A1 5/2012 Zimmerman et al.
 2012/0122570 A1 5/2012 Baronoff
 2012/0127201 A1 5/2012 Kim et al.
 2012/0219181 A1 8/2012 Tseng et al.
 2012/0231891 A1 9/2012 Watkins, Jr. et al.
 2012/0244950 A1 9/2012 Braun
 2012/0276997 A1 11/2012 Chowdhary et al.
 2012/0293506 A1 11/2012 Vertucci et al.
 2012/0302129 A1 11/2012 Persaud et al.
 2013/0050496 A1 2/2013 Jeong
 2013/0064426 A1 3/2013 Watkins, Jr. et al.
 2013/0073988 A1 3/2013 Groten et al.
 2013/0128060 A1 5/2013 Rhoads et al.
 2013/0159096 A1 6/2013 Santhanagopal et al.
 2013/0176202 A1 7/2013 Gervautz
 2014/0161323 A1 6/2014 Livyatan et al.
 2014/0184749 A1 7/2014 Hilliges et al.
 2015/0176262 A1 6/2015 Martini

FOREIGN PATENT DOCUMENTS

EP 1 354 260 10/2003
 EP 1 119 798 B1 3/2005
 EP 2 207 113 A1 7/2010
 JP 2010-118019 A 5/2010
 JP 2011-153324 A 8/2011
 JP 2011-253324 A 12/2011
 KR 2010-0124947 A 11/2010
 KR 10-1171264 B1 8/2012
 WO 97/44737 A1 11/1997
 WO 99/42946 A2 8/1999
 WO 99/42947 A2 8/1999
 WO 00/20929 A1 4/2000
 WO 01/63487 A1 8/2001
 WO 01/71282 A1 9/2001
 WO 02/03091 A2 1/2002
 WO 02/059716 A2 8/2002
 WO 02/073818 A1 9/2002
 WO 2007/140155 A2 12/2007
 WO 2010/079876 A1 7/2010
 WO 2010/138344 A2 12/2010
 WO 2011/028720 A1 3/2011
 WO 2013/023705 A1 2/2013

OTHER PUBLICATIONS

Wauters, "Stanford Graduates Release Pulse, A Must-Have News App for the iPad," Techcrunch.com, techcrunch.com/2010/05/31/pulse-ipad/, 2010.
 Hickins, "A License to Pry," The Wall Street Journal, <http://blogs.wsj.com/digits/2011/03/10/a-license-to-pry/tab/print/>, 2011.

Notice of Reasons for Rejection issued in Japanese Patent Application No. 2014-503962 dated Sep. 22, 2014.
 Notice of Reasons for Rejection issued in Japanese Patent Application No. 2014-503962 dated Jun. 30, 2015.
 European Search Report issued in European Patent Application No. 12767566.8 dated Mar. 20, 2015.
 "3D Laser Mapping Launches Mobile Indoor Mapping System," 3D Laser Mapping, Dec. 3, 2012, 1 page.
 Banwell et al., "Combining Absolute Positioning and Vision for Wide Area Augmented Reality," Proceedings of the International Conference on Computer Graphics Theory and Applications, 2010, 4 pages.
 Li et al., "3-D Motion Estimation and Online Temporal Calibration for Camera-IMU Systems," Proceedings of the IEEE International Conference on Robotics and Automation (ICRA), 2013, 8 pages.
 Li et al., "High-fidelity Sensor Modeling and Self-Calibration in Vision-aided Inertial Navigation," Proceedings of the IEEE International Conference on Robotics and Automation (ICRA), 2014, 8 pages.
 Li et al., "Online Temporal Calibration for Camera-IMU Systems: Theory and Algorithms," International Journal of Robotics Research, vol. 33, Issue 7, 2014, 16 pages.
 Li et al., "Real-time Motion Tracking on a Cellphone using Inertial Sensing and a Rolling-Shutter Camera," Proceedings of the IEEE International Conference on Robotics and Automation (ICRA), 2013, 8 pages.
 Mourikis, "Method for Processing Feature Measurements in Vision-Aided Inertial Navigation," 3 pages, 2013.
 Mourikis et al., "Methods for Motion Estimation With a Rolling-Shutter Camera," Proceedings of the IEEE International Conference on Robotics and Automation (ICRA), Karlsruhe, Germany May 6-10, 2013, 9 pages.
 Panzarino, "What Exactly WiFiSlam Is, and Why Apple Acquired It," <http://thenextweb.com/apple/2013/03/26/what-exactly-wifislam-is-and-why-apple-acquired-it>, Mar. 26, 2013, 10 pages.
 Vondrick et al., "HOGgles: Visualizing Object Detection Features," IEEE International Conference on Computer Vision (ICCV), 2013, 9 pages.
 Vu et al., "High Accuracy and Visibility-Consistent Dense Multiview Stereo," IEEE Transactions on Pattern Analysis and Machine Intelligence, 2012, vol. 34, No. 5, 13 pages.
 International Search Report and Written Opinion issued in International Application No. PCT/US2014/061283 dated Aug. 5, 2015, 11 pages.
 Pang et al., "Development of a Process-Based Model for Dynamic Interaction in Spatio-Temporal GIS", GeoInformatica, 2002, vol. 6, No. 4, pp. 323-344.
 Zhu et al., "The Geometrical Properties of Irregular 2D Voronoi Tessellations," Philosophical Magazine A, 2001, vol. 81, No. 12, pp. 2765-2783.
 U.S. Appl. No. 16/186,405, filed Nov. 9, 2018.
 "S2 Cells," S2Geometry, https://s2geometry.io/devguide/s2cell_hierarchy, 27 pages, Oct. 10, 2019.
 U.S. Appl. No. 16/557,963, filed Aug. 30, 2019.

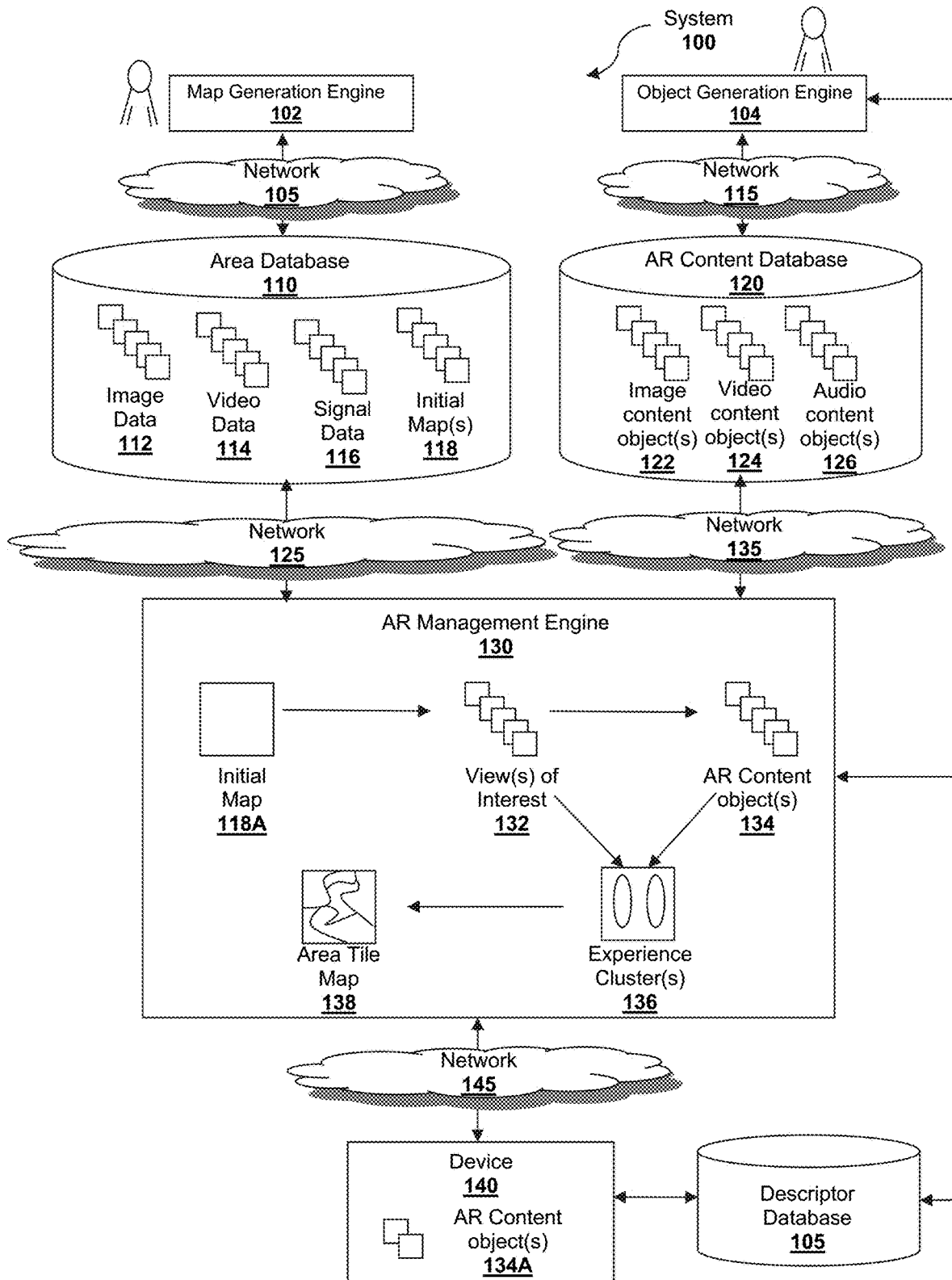


Figure 1

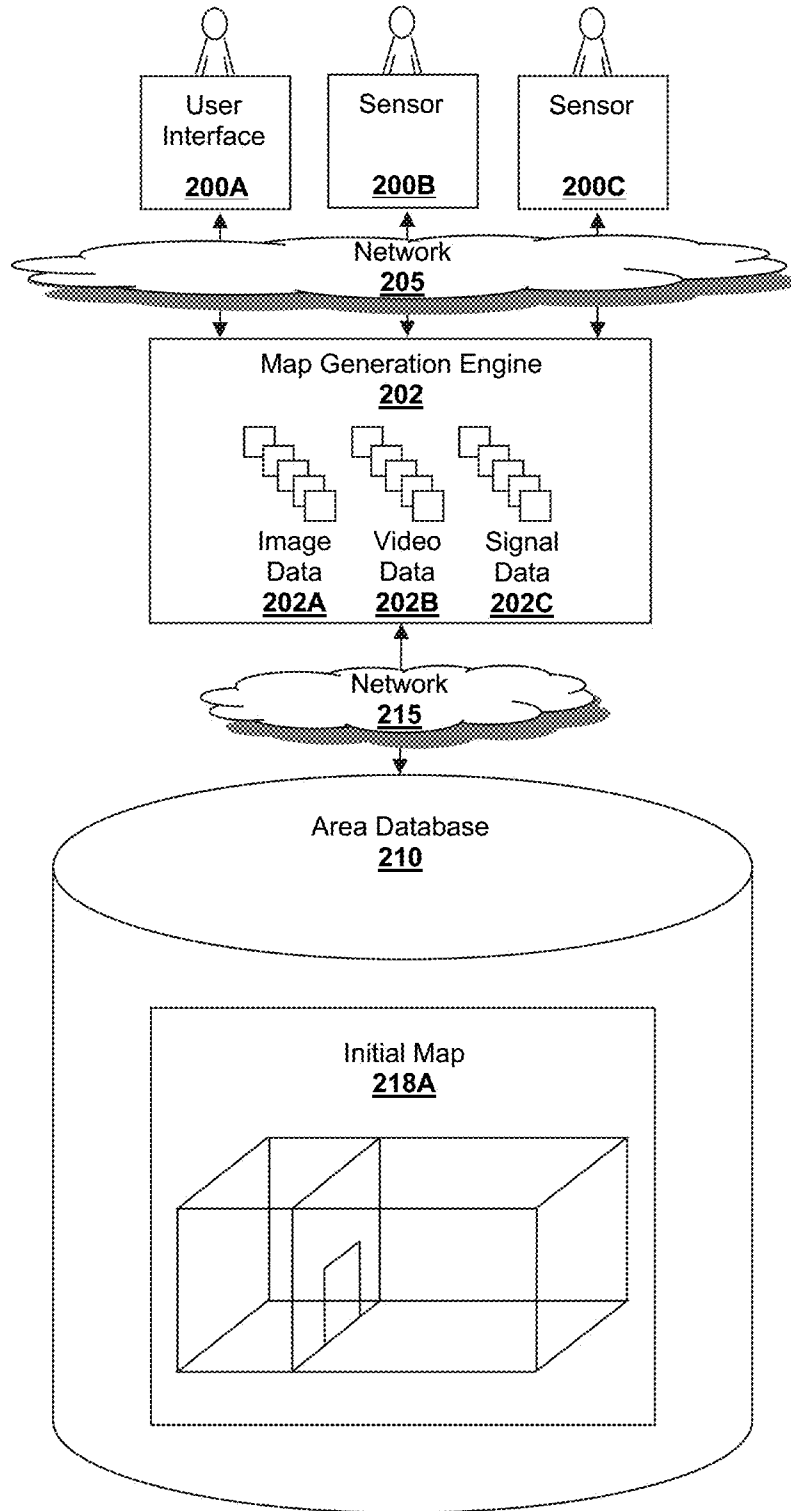


Figure 2

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