

(51) International Patent Classification:
G06F 17/21 (2006.01)(21) International Application Number:
PCT/US2013/060541(22) International Filing Date:
19 September 2013 (19.09.2013)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
13/657,092 22 October 2012 (22.10.2012) US(71) Applicant (for all designated States except US): **THE GOVERNMENT OF THE UNITED STATES OF AMERICA AS REPRESENTED BY THE SECRETARY OF THE NAVY** [US/US]; Naval Research Laboratory, 4555 Overlook Ave, SW, Code 1008.2, Washington, DC 20375 (US).

(72) Inventors; and

(71) Applicants (for US only): **SAMPLE, John, T.** [US/US]; 500 Cutter Circle, Pearl River, LA 70452 (US). **IOUP, Elias, Z.K.** [US/US]; 4707 Lafaye Street, New Orleans, LA 70122 (US).(74) Agent: **RESSING, Amy, L.**; Code 1008.2, US Naval Research Laboratory, 4555 Overlook Ave, SW, Washington, DC 20375 (US).

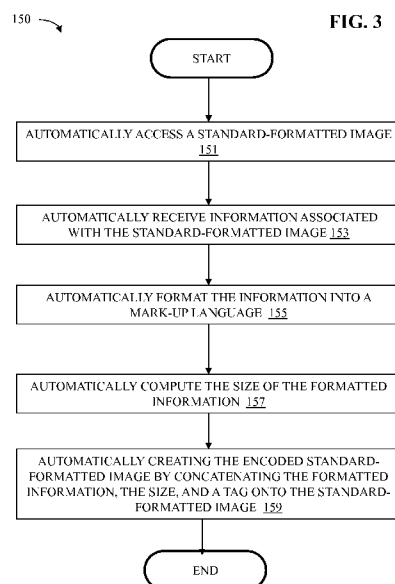
(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: SYSTEM AND METHOD FOR ENCODING STANDARD-FORMATTED IMAGES WITH INFORMATION



(57) Abstract: System and method for encoding standard-formatted images with information including, but not limited to, geospatial information. This information, possibly in mark-up language format, can be quickly accessed and used to modify the image to which it is appended, or it can be ignored because the image itself remains unchanged. This enables the standard-formatted images to be shown in geospatial information systems as map images, while preserving their compatibility with other systems like web browsers and mobile phones.

SYSTEM AND METHOD FOR ENCODING STANDARD-FORMATTED IMAGES WITH INFORMATION

TECHNICAL FIELD

5 **[0001]** Systems and methods disclosed herein relate generally to augmenting existing standard-formatted images.

BACKGROUND ART

10 **[0002]** Standard image formats such as PNG, JPEG, and others are widely used, but there is no standard way, or sometimes no way, to attach information to those kinds of files, and therefore no standard way to process any attached information, if any. These formats have some ability to store image metadata, but existing methods for storing metadata suffer several problems. First, they are format-specific, for example, a method for attaching metadata to a JPEG file is different from a method for attaching metadata to a PNG file. Second, existing methods do not specifically allow for addition of geospatial metadata. Third, existing methods
15 embed metadata within the structure of the image in varying positions based on image format. For example, the GeoTIFF format adds rich geospatial tags to standard TIFF images. However, TIFF images are not as widely used as JPEGs and PNGs. Also, GeoTIFF tags do not support the full expressiveness offered by an extensible mark-up language, for example, but not limited to, XML.

20 **[0003]** What is needed is a system in which images could be encoded within images, images could be signed digitally, change history could be encoded, and image labels and other annotations could be encoded along with the image. These capabilities exist for PDF documents, but not for other formats and not in a way that can be processed in a standard way.

DISCLOSURE OF THE INVENTION

25 **[0004]** The system and method of the present embodiment address the needs of encoding standard-formatted images with information, for example, but not limited to, geospatial information. The system and method of the present embodiment allow geospatial information, such as map coordinates, scale, projection, datum, and others to be attached to standard-formatted images such as, for example, but not limited to, PNG, TIFF, BMP, GIF, JPEG, and many other image types. This enables the standard-formatted images to be shown
30 in geospatial information systems as map images, while preserving their compatibility with other systems like web browsers and mobile phones.

35 **[0005]** The system and method of the present embodiment provide for attaching information to any image, regardless of format, in a way that can be processed with the same computer code by any reader, regardless of the format of the standard-formatted image. The structure of the new format allows the standard-formatted image to be readable in the current way as well as by technology that could make use of the attached information. Adding data to the end of a standard-formatted image file preserves compatibility with all known image readers. Finalizing the additional data with a special tag allows computer code to quickly determine if the additional data are present. Including the size of the attached information, perhaps formatted in XML format, allows computer code to quickly retrieve the attached information. The XML format itself provides a rich,

extensible set of capabilities for example, but not limited to, embedding thumbnail or alternative images of the standard-format image, encoding digital signature information, providing document change history, and providing labels and annotations for the standard-format image. The user can also define data specific to the particular standard-format image.

5

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] FIG. 1 is a pictorial representation of the data structure of the image of the present embodiment;

10 **[0007]** FIG. 2 is a schematic block diagram of one embodiment of the system of the present teachings; and

[0008] FIG. 3 is a flowchart of the method of one embodiment of the present teachings.

MODES FOR CARRYING OUT THE INVENTION

15 **[0009]** The problems set forth above as well as further and other problems are solved by the present teachings. These solutions and other advantages are achieved by the various embodiments of the teachings described herein below.

[00010] Referring now to FIG. 1, the system and method of the present embodiment add a mark-up language document to the end of any standard image format by using modified format 20. The system and method of the present embodiment create, for example, but not limited to, an XML schema document that outlines the proper, but extensible, structure of the XML documents that can be appended to image files. Standard image format 11 is image data in a standard format such as, for example, but not limited to, PNG, TIFF, BMP, GIF, JPEG, and any other image format. Standard image format 11 is exactly as any standard image would be, the internals are unchanged. Following standard image format 11 is mark-up language document 13 encoded as bytes, followed by document size 15 in bytes. Mark-up language document 13 can include, for example, but not limited to, print-related information, such as, for example, but not limited to, the trimming bounds for a printed image, and the Dots Per Inch (DPI) of the printed image. Mark-up language document 13 can also include information about the collection of the image, for example, but not limited to, the camera model, the satellite model, and the time and date of image capture. Still further, mark-up language document 13 can include the classification markings for the image. Attaching document size 15 to the image file allows quick retrieval of the size of mark-up language document 13. Magic number 17, eight bytes long and can be any number, follows document size 15. It is a tag indicating that a record has been added.

[00011] Referring now to FIG. 2, system 100 for encoding standard-formatted images 113 with associated information 112 can include, but is not limited to including, image accessor 101 automatically accessing standard-formatted image 113 from, for example, but not limited to, image database 131 through, for example, but not limited to, electronic communications 133. System 100 can also include information receiver 102 automatically receiving information 112 associated with standard-formatted image 113 from, for example, but not limited to, user input or information database 135 through, for example, but not limited to, electronic communications 133. System 100 can still further include formatter 103 automatically formatting information

112 into formatted information 115 which is formatted according to a mark-up language, and sizer 107 automatically computing size 116 of formatted information 115. System 100 can also include image modifier 105 automatically creating encoded standard-formatted image 125 by concatenating formatted information 115, size 116, and a tag onto standard-formatted image 113. Image modifier 105 can optionally provide encoded
5 image 125 to, for example, but not limited to, image display 139 or stored images 137 through, for example, but not limited to, electronic communications 133. Information 112 can optionally include geospatial information, a digital signature, or document change history. The mark-up language can optionally be XML. The standard-formatted image can optionally be, for example, but not limited to, a JPEG image, a PNG image, a TIFF image, a BMP image, a GIF image, or any other image type. The tag can optionally include eight bytes.

10 **[00012]** Referring now to FIG. 3, method 150 for encoding standard-formatted images with associated information can include, but is not limited to including, the steps of automatically accessing 151 a standard-formatted image, automatically receiving 153 information associated with the standard-formatted image, automatically formatting 155 the information into a mark-up language, automatically computing 157 the size of the formatted information, and automatically creating 159 the encoded standard-formatted image by
15 concatenating the formatted information, the size, and a tag onto the standard-formatted image. The information can optionally include geospatial information, at least one digital signature, and document change history. The mark-up language can be, for example, but not limited to, XML. The standard-formatted image can be, for example, but not limited to, a JPEG image, a PNG image, a TIFF image, a BMP image, a GIF image, or any other image type. The tag can optionally include, for example, eight bytes.

20 **[00013]** Embodiments of the present teachings are directed to computer systems for accomplishing the methods discussed in the description herein, and to computer readable media containing programs for accomplishing these methods. The raw data and results can be stored for future retrieval and processing, printed, displayed, transferred to another computer, and/or transferred elsewhere. Communications links can be wired or wireless, for example, using cellular communication systems, military communications systems, and satellite
25 communications systems. In an exemplary embodiment, the software for the system is written in FORTRAN and C. The system operates on a computer having a variable number of CPUs. Other alternative computer platforms can be used. The operating system can be, for example, but is not limited to, WINDOWS® or LINUX®.

30 **[00014]** The present embodiment is also directed to software for accomplishing the methods discussed herein, and computer readable media storing software for accomplishing these methods. The various modules described herein can be accomplished on the same CPU, or can be accomplished on a different computer. In compliance with the statute, the present embodiment has been described in language more or less specific as to structural and methodical features. It is to be understood, however, that the present embodiment is not limited to the specific features shown and described, since the means herein disclosed comprise preferred forms of putting
35 the present embodiment into effect.

[00015] Referring again primarily to FIG. 3, method 150 can be, in whole or in part, implemented electronically. Signals representing actions taken by elements of system 100 (FIG. 2) and other disclosed embodiments can travel over at least one live communications network and/or through electronic communications 133 (FIG. 2). Control and data information can be electronically executed and stored on at least
40 one computer-readable medium. The system can be implemented to execute on at least one computer node 114

(FIG. 2) in at least one live communications network and/or through electronic communications 133 (FIG. 2).

Common forms of at least one computer-readable medium can include, for example, but not be limited to, a floppy disk, a flexible disk, a hard disk, magnetic tape, or any other magnetic medium, a compact disk read only memory or any other optical medium, punched cards, paper tape, or any other physical medium with patterns of
5 holes, a random access memory, a programmable read only memory, and erasable programmable read only memory (EPROM), a Flash EPROM, or any other memory chip or cartridge, or any other medium from which a computer can read. Further, the at least one computer readable medium can contain images in any form including, but not limited to, Graphic Interchange Format (GIF), Joint Photographic Experts Group (JPEG), Portable Network Graphics (PNG), Scalable Vector Graphics (SVG), and Tagged Image File Format (TIFF).

10 **[00016]** The invention has been described with reference to certain embodiments. It will be understood, however, that the invention is not limited to the embodiments discussed above, and that modification and variations are possible within the scope of the appended claims.

[00017] What is claimed is:

1. An automatic method for encoding standard-formatted images with associated information comprising the steps of:

automatically accessing a standard-formatted image;
automatically receiving information associated with the standard-formatted image;
5 automatically formatting the information into a mark-up language;
automatically computing the size of the formatted information; and
automatically creating the encoded standard-formatted image by concatenating the formatted
information, the size, and a tag onto the standard-formatted image.

10 2. The method as in claim 1 wherein the information comprises geospatial information.

3. The method as in claim 1 wherein the information comprises a digital signature.

15 4. The method as in claim 1 wherein the information comprises document change history.

5. The method as in claim 1 wherein the mark-up language comprises XML.

6. The method as in claim 1 wherein the standard-formatted image comprises any of a JPEG image, a PNG
image, a TIFF image, a BMP image, a GIF image.

20 7. The method as in claim 1 wherein the tag comprises eight bytes.

8. A computer system for encoding standard-formatted images with associated information comprising:

an image accessor automatically accessing a standard-formatted image;
25 an information receiver automatically receiving information associated with the standard-formatted
image;
a formatter automatically formatting the information into a mark-up language;
a sizer automatically computing the size of the formatted information; and
an image modifier automatically creating the encoded standard-formatted image by concatenating the
30 formatted information, the size, and a tag onto the standard-formatted image.

9. The method as in claim 8 wherein the information comprises geospatial information.

10. The method as in claim 8 wherein the information comprises a digital signature.

35 11. The method as in claim 8 wherein the information comprises document change history.

12. The method as in claim 8 wherein the mark-up language comprises XML.

13. The method as in claim 8 wherein the standard-formatted image comprises any of a JPEG image, a PNG image, a TIFF image, a BMP image, a GIF image.

14. The method as in claim 8 wherein the tag comprises eight bytes.

5

15. A computer method for encoding standard-formatted images with associated information comprising:

computer code stored on computer-readable media executing the steps of

automatically accessing a standard-formatted image;

automatically receiving information associated with the standard-formatted image;

10

automatically formatting the information into a mark-up language;

automatically computing the size of the formatted information; and

automatically creating the encoded standard-formatted image by concatenating the formatted information, the size, and a tag onto the standard-formatted image.

15

16. The computer system as in claim 15 wherein the information is selected from the group consisting of at least one digital signature and document change history.

17. The computer system as in claim 15 wherein the mark-up language comprises XML.

20

18. The computer system as in claim 15 wherein the standard-formatted image comprises any of a JPEG image, a PNG image, a TIFF image, a BMP image, a GIF image.

19. The computer system as in claim 15 wherein the tag comprises eight bytes.

25

20. The computer system as in claim 15 wherein the information comprises geospatial information.

1/3

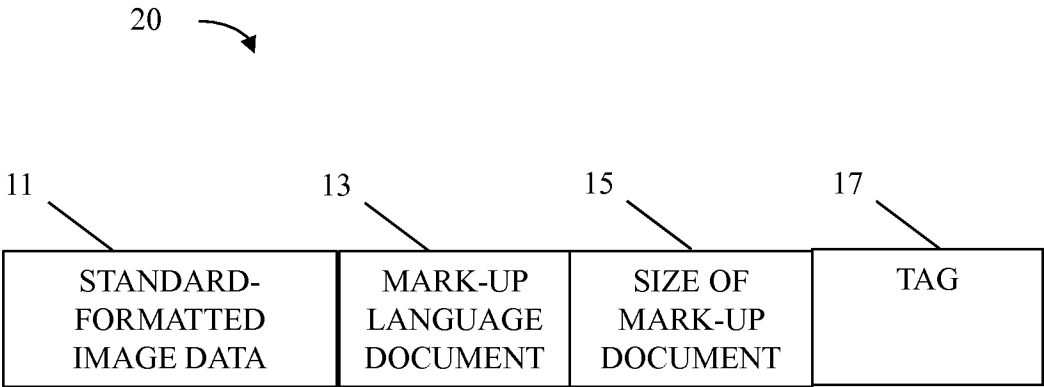
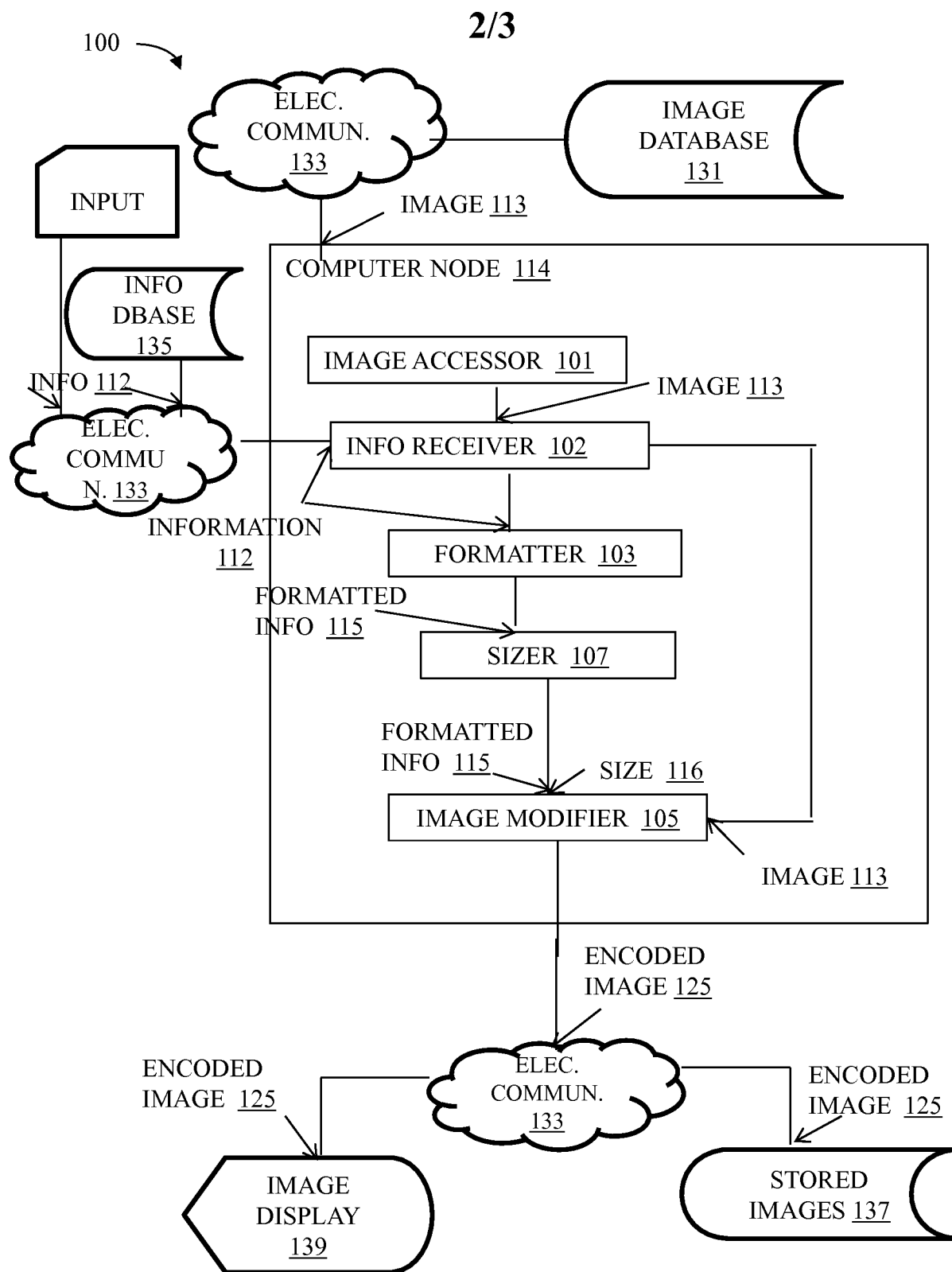


FIG. 1



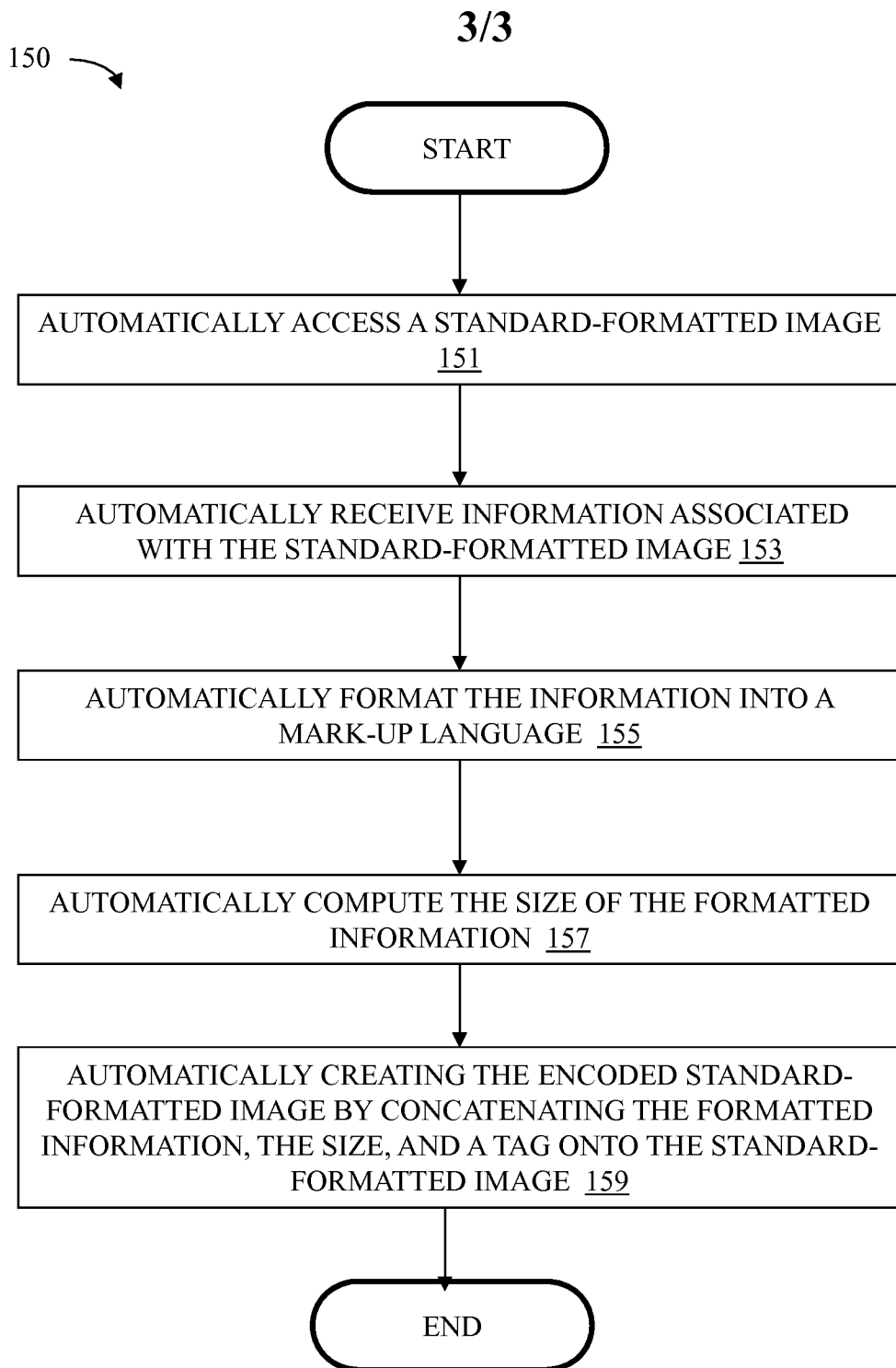


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2013/060541**A. CLASSIFICATION OF SUBJECT MATTER****G06F 17/21(2006.01)i**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G06F 17/21; G06F 15/16; G06K 9/68; H04N 5/76; G06F 17/30

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: image, standard, format, metadata, tag, convert, additional information, insert, geospatial, encode, XML, mark-up, and similar terms.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2010-0277611 A1 (ADAM HOLT et al.) 04 November 2010 See paragraphs [0029], [0033], [0035], [0039], and [0046]; figure 1; and claims 1, 3, and 22-23.	1-20
Y	US 2003-0187952 A1 (GARY YOUNG et al.) 02 October 2003 See paragraph [0011] and claim 1.	1-20
A	US 2011-0087662 A1 (GEORGE DERRICK DARBY, JR. et al.) 14 April 2011 See paragraph [0057]; figure 3; and claim 1.	1-20
A	WO 2008-058253 A2 (CRYPTOMETRICS, INC.) 15 May 2008 See paragraphs [0005]-[0007] and [0015]-[0016]; figure 1; and claim 2.	1-20
A	US 2011-0072015 A1 (JYH-HAN LIN et al.) 24 March 2011 See paragraphs [0003] and [0031]-[0033]; figure 4; and claim 9.	1-20

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

07 January 2014 (07.01.2014)

Date of mailing of the international search report

08 January 2014 (08.01.2014)

Name and mailing address of the ISA/KR

Korean Intellectual Property Office
189 Cheongsu-ro, Seo-gu, Daejeon Metropolitan City,
302-701, Republic of Korea

Facsimile No. +82-42-472-7140

Authorized officer

NHO, Ji Myong

Telephone No. +82-42-481-8528



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2013/060541

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2010-0277611 A1	04/11/2010	US 8392957 B2 WO 2010-127308 A2 WO 2010-127308 A3	05/03/2013 04/11/2010 24/02/2011
US 2003-0187952 A1	02/10/2003	None	
US 2011-0087662 A1	14/04/2011	CN 102792322 A DE 112010003865 T5 WO 2011-041618 A2 WO 2011-041618 A3	21/11/2012 31/01/2013 07/04/2011 30/06/2011
WO 2008-058253 A2	15/05/2008	AU 2007-317234 A1 AU 2007-317234 B2 CA 2669269 A1 EP 2097854 A2 EP 2097854 A4 GB 0909740 D0 GB 2457194 A MX 2009004990 A US 2008-123967 A1 US 8295649 B2 WO 2008-058253 A3	15/05/2008 08/11/2012 15/05/2008 09/09/2009 27/03/2013 22/07/2009 12/08/2009 08/02/2010 29/05/2008 23/10/2012 02/04/2009
US 2011-0072015 A1	24/03/2011	US 8370358 B2	05/02/2013