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Attorneys for Plaintiff
MAP TOOL INC.

UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA

NC

MAP TOOL INC.,

Plaintiff,

vs.

ARCHOS S.A. AND ARCHOS INC.,

Defendants.

Case No. CV 13 4944

COMPLAINT FOR PATENT INFRINGEMENT

Plaintiff Map Tool Inc. ("Plaintiff" or "Map Tool") by and through its undersigned counsel, files this Complaint against Archos S.A. and Archos Inc. (collectively, "Defendants" or "Archos").

THE PARTIES

1. Map Tool is a Delaware corporation having its principal place of business in Wilmington, Delaware.

2. Upon information and belief, Archos S.A. is a French corporation having its principal place of business at 12, rue Ampère, 91430 Igny, France.

3. Upon information and belief, Archos Inc. is a California corporation with its principal place of business at 7951 E. Maplewood Avenue #260, Greenwood Village, CO 80111. Upon information and belief, Archos Inc. is a subsidiary of Archos S.A.

4. Upon information and belief, Defendants have conducted and regularly conduct business within this District, have purposefully availed themselves of the privileges of conducting business in this District, and have sought protection and benefit from the laws of the State of California.

NATURE OF THE ACTION

5. In this civil action, Plaintiff seeks damages against Archos for acts of patent infringement in violation of the Patent Act of the United States, 35 U.S.C. §§ 1 *et seq*., including but not limited to 35 U.S.C. §§ 271, 281, 284, and 285.

JURISDICTION AND VENUE

6. This Court has subject matter jurisdiction of such federal question claims pursuant to 28 U.S.C. §§ 1331 and 1338(a).

7. On information and belief, this Court has personal jurisdiction over Defendants. Defendants have conducted and regularly conduct business within the United States and this District. Defendants have purposely availed themselves of the privileges of conducting business in the United States, and more specifically in the State of California and this District. Defendants have sought protection and benefit from the laws of the State of California by placing infringing products into the stream of commerce through an established distribution channel with the awareness and/or intent that they will be purchased by consumers in this District.

8. Venue is proper in this Court according to the venue provisions set forth by 28 U.S.C. §§ 1391(b)-(d) and 1400(b). Defendants are subject to personal jurisdiction in this District, and therefore are deemed to reside in this District for purposes of venue. Upon information and belief, Defendants have committed acts within this District giving rise to this action and do business in this District, including but not limited to making sales in this District, providing service and support to its respective customers in this District and/or operating an interactive website, available to persons in this District that advertises, markets, and/or offers for sale infringing products.

BACKGROUND

9. U.S. Patent No. 7,948,502 titled "Method of Displaying Picture Having Location Data and Apparatus Thereof" (the "'502 patent") was duly and legally issued by the U.S. Patent and

Trademark Office on May 24, 2011, after full and fair examination. Craig Stanton is the sole inventor listed on the '502 patent. The '502 patent has been assigned to Plaintiff, and Plaintiff holds all rights, title, and interest in the '502 patent, including the right to collect and receive damages for past, present and future infringement. A true and correct copy of the '502 patent is attached as Exhibit A and made a part hereof.

10. U.S. Patent No. 8,249,804 titled "Systems and Methods for Smart City Search" (the "'804 patent") was duly and legally issued by the U.S. Patent and Trademark Office on August 21, 2012, after full and fair examination. Anatole M. Lokshin and Ailin Mao are the inventors listed on the '804 patent. The '804 patent has been assigned to Plaintiff, and Plaintiff holds all rights, title, and interest in the '804 patent, including the right to collect and receive damages for past, present and future infringement. A true and correct copy of the '804 patent is attached as Exhibit B and made a part hereof.

11. Upon information and belief, Defendants make, use, offer to sell, and/or sell within, and/or import into the United States products that incorporate the fundamental technologies covered by the '502 and '804 patents (collectively, the "patents-in-suit"). By incorporating the fundamental inventions covered by the patents-in-suit, Defendants can make improved products.

COUNT I

Patent Infringement of U.S. Patent No. 7,948,502

12. Plaintiff repeats and re-alleges each and every allegation of paragraphs 1-11 as though fully set forth herein.

13. The '502 patent is valid and enforceable.

14. Defendants have never been licensed, either expressly or impliedly, under the '502 patent.

15. Upon information and belief, Defendants have been and are directly infringing under 35 U.S.C. § 271(a), either literally or under the doctrine of equivalents, the '502 patent by making, using, offering to sell, and/or selling to manufacturers, distributors, customers and/or consumers (directly or through intermediaries and/or subsidiaries) in this District and elsewhere within the

United States and/or importing into the United States, without authority, electronic devices, such as smartphones and tablets, that include all of the limitations of one or more claims of the '502 patent.

16. As a direct and proximate result of these acts of patent infringement, Defendants have encroached on the exclusive rights of Plaintiff to practice the '502 patent, for which Plaintiff is entitled to at least a reasonable royalty.

COUNT II

Patent Infringement of U.S. Patent No. 8,249,804

17. Plaintiff repeats and re-alleges each and every allegation of paragraphs 1-16 as though fully set forth herein.

18. The '804 patent is valid and enforceable.

19. Defendants have never been licensed, either expressly or impliedly, under the '804 patent.

20. Upon information and belief, Defendants have been and are directly infringing under 35 U.S.C. § 271(a), either literally or under the doctrine of equivalents, the '804 patent by making, using, offering to sell, and/or selling to manufacturers, distributors, customers and/or consumers (directly or through intermediaries and/or subsidiaries) in this District and elsewhere within the United States and/or importing into the United States, without authority, electronic devices, such as smartphones and tablets, that include all of the limitations of one or more claims of the '804 patent.

21. As a direct and proximate result of these acts of patent infringement, Defendants have encroached on the exclusive rights of Plaintiff to practice the '804 patent, for which Plaintiff is entitled to at least a reasonable royalty.

CONCLUSION

22. Plaintiff is entitled to recover from Defendants the damages sustained by Plaintiff as a result of Defendants' wrongful acts in an amount subject to proof at trial, which, by law, cannot be less than a reasonable royalty, together with interest and costs as fixed by this Court.

23. Plaintiff has incurred and will incur attorneys' fees, costs, and expenses in the prosecution of this action. The circumstances of this dispute create an exceptional case within the

meaning of 35 U.S.C. § 285, and Plaintiff is entitled to recover its reasonable and necessary attorneys' fees, costs, and expenses.

JURY DEMAND

24. Plaintiff hereby requests a trial by jury pursuant to Rule 38 of the Federal Rules of Civil Procedure.

PRAYER FOR RELIEF

25. Plaintiff respectfully requests that the Court find in its favor and against Defendants, and that the Court grant Plaintiff the following relief:

A. A judgment that Defendants have directly infringed the patents-in-suit as alleged herein;

B. A judgment for an accounting of all damages sustained by Plaintiff as a result of the acts of infringement by Defendants;

C. A judgment and order requiring Defendants to pay Plaintiff damages under 35 U.S.C. § 284;

D. A judgment and order requiring Defendants to pay Plaintiff pre-judgment and post-judgment interest on the damages awarded;

E. A judgment and order finding this to be an exceptional case and requiring Defendants to pay the costs of this action (including all disbursements) and attorneys' fees as provided by 35 U.S.C. § 285; and

F. Such other and further relief as the Court deems just and equitable.

Dated: October 24, 2013

Respectfully submitted,

/s/ Michael C. Ting

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Attorneys for Plaintiff
MAP TOOL INC.

Exhibit A

US007948502B2

(12) **United States Patent**
Stanton

(10) **Patent No.: US 7,948,502 B2**
(45) **Date of Patent: May 24, 2011**

(54) **METHOD OF DISPLAYING PICTURE HAVING LOCATION DATA AND APPARATUS THEREOF**

(75) Inventor: **Craig Stanton**, Northcote Auckland (NZ)

(73) Assignee: **Mitac International Corp.**, Taoyuan (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 641 days.

(21) Appl. No.: **12/153,025**

(22) Filed: **May 13, 2008**

(65) **Prior Publication Data**

US 2009/0284551 A1 Nov. 19, 2009

(51) **Int. Cl.**
G09G 5/00 (2006.01)
G06T 11/20 (2006.01)

(52) **U.S. Cl.** **345/629**; 345/440; 345/660

(58) **Field of Classification Search** 345/629, 345/660, 440

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,714,215 B1 * 3/2004 Flora et al. 715/716
7,474,317 B2 * 1/2009 Dolph et al. 345/629
7,840,344 B2 * 11/2010 Sloo 701/208

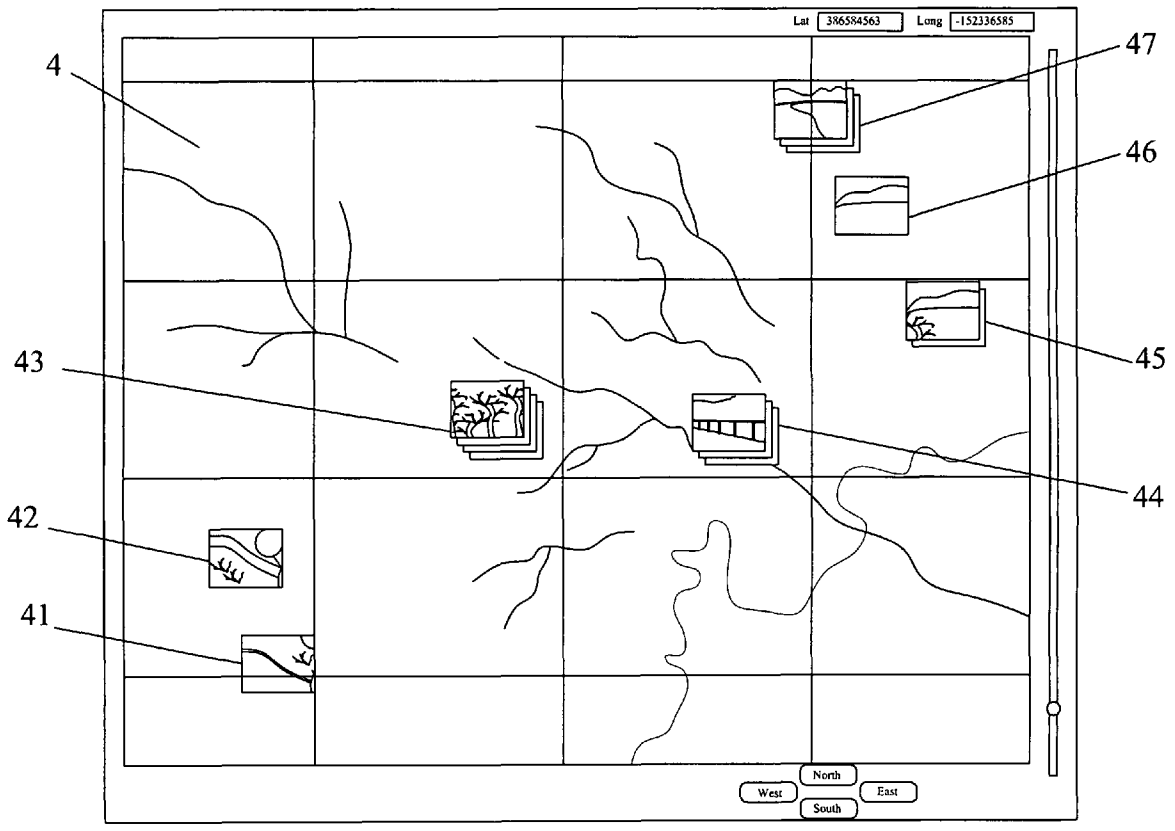
* cited by examiner

Primary Examiner — Ryan R Yang
(74) *Attorney, Agent, or Firm* — Wang Law Firm, Inc.; Li K. Wang

(57) **ABSTRACT**

One objective of the present invention is to provide a method of displaying picture having location data and apparatus thereof. The method comprising the steps of providing an electronic map and a plurality of pictures having location data, and generating a plurality of thumbnails corresponding to the pictures based on a scale, and then displaying the thumbnails on the electronic map based on the location data of corresponding picture of each thumbnail, and further overlappingly displaying the thumbnails of which the distance between the thumbnails is shorter than a threshold on the electronic map.

32 Claims, 7 Drawing Sheets



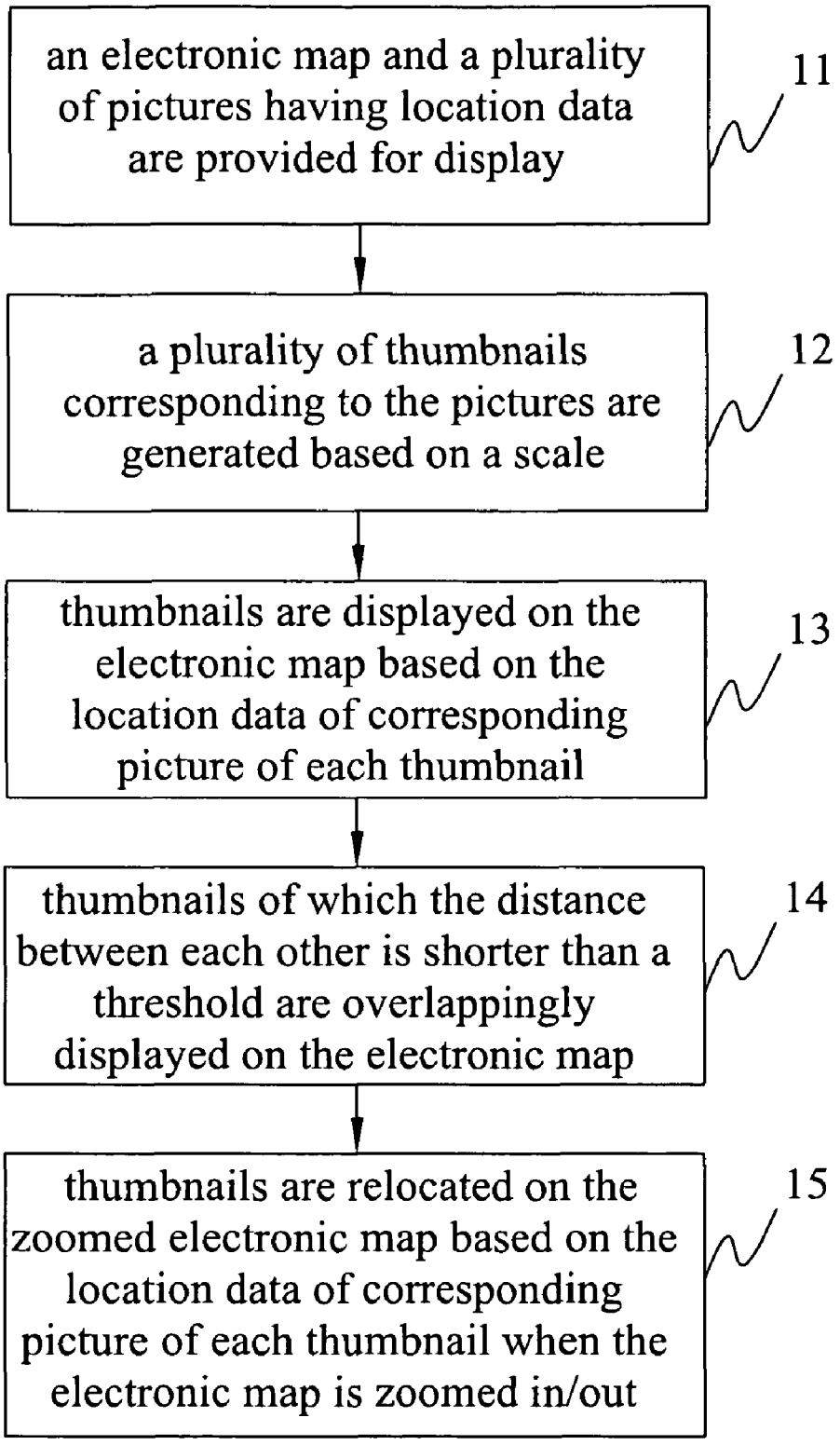
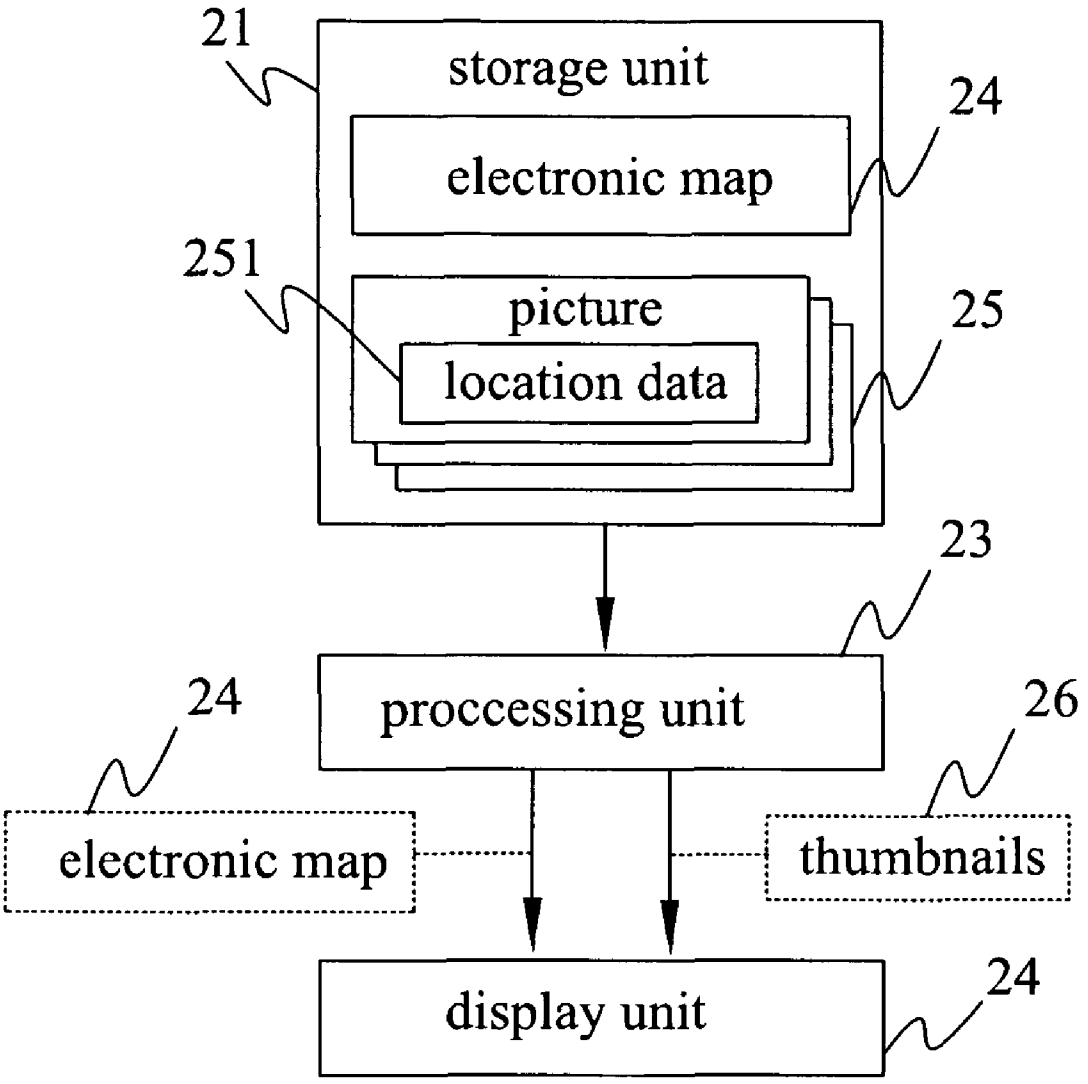

an electronic map and a plurality of pictures having location data are provided for display
11
a plurality of thumbnails corresponding to the pictures are generated based on a scale
12
thumbnails are displayed on the electronic map based on the location data of corresponding picture of each thumbnail
13
thumbnails of which the distance between each other is shorter than a threshold are overlappingly displayed on the electronic map
14
thumbnails are relocated on the zoomed electronic map based on the location data of corresponding picture of each thumbnail when the electronic map is zoomed in/out
15

FIG.1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23
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display unit
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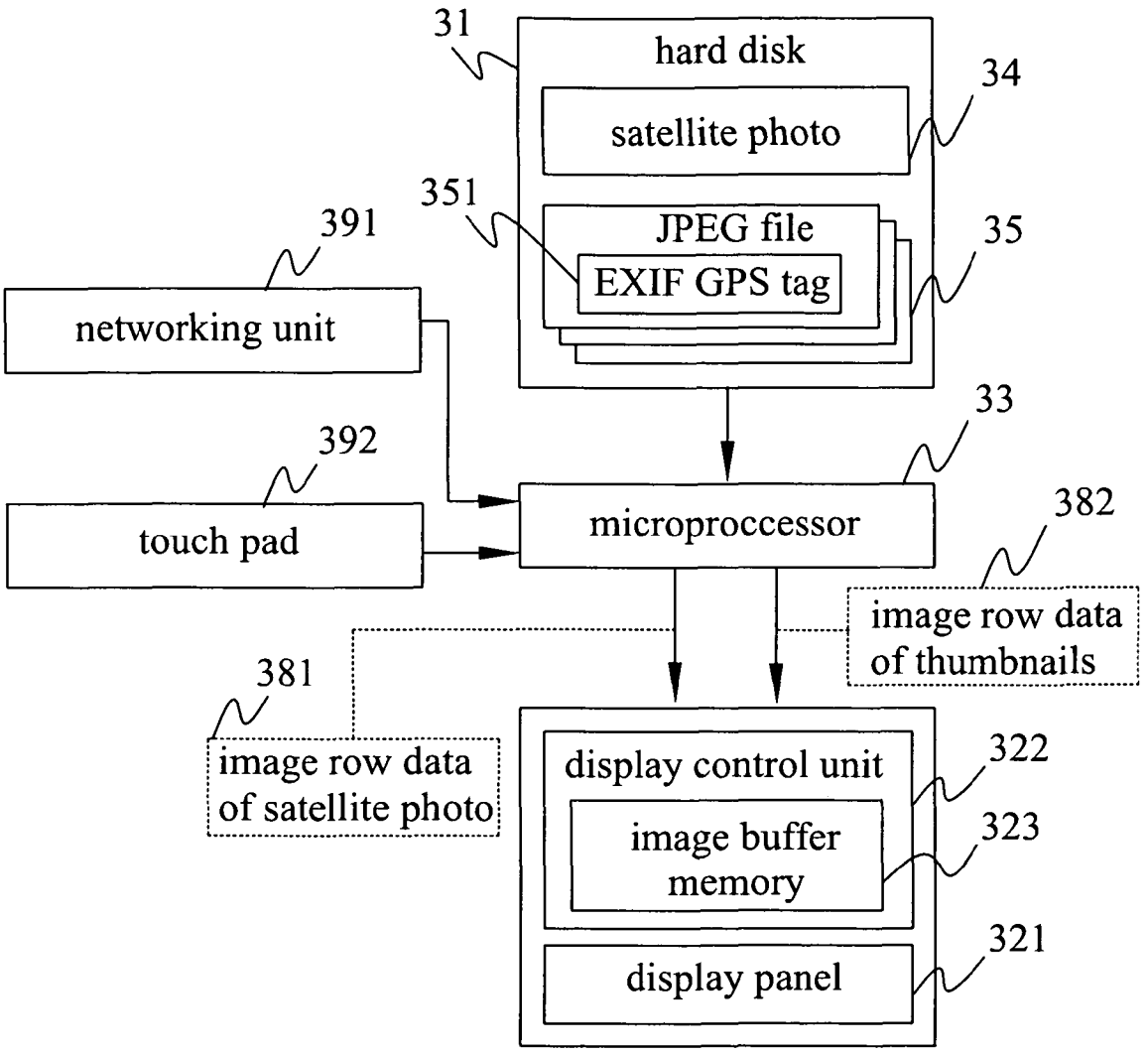
FIG.2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display control unit
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image buffer
memory
323
321
display panel

FIG.3

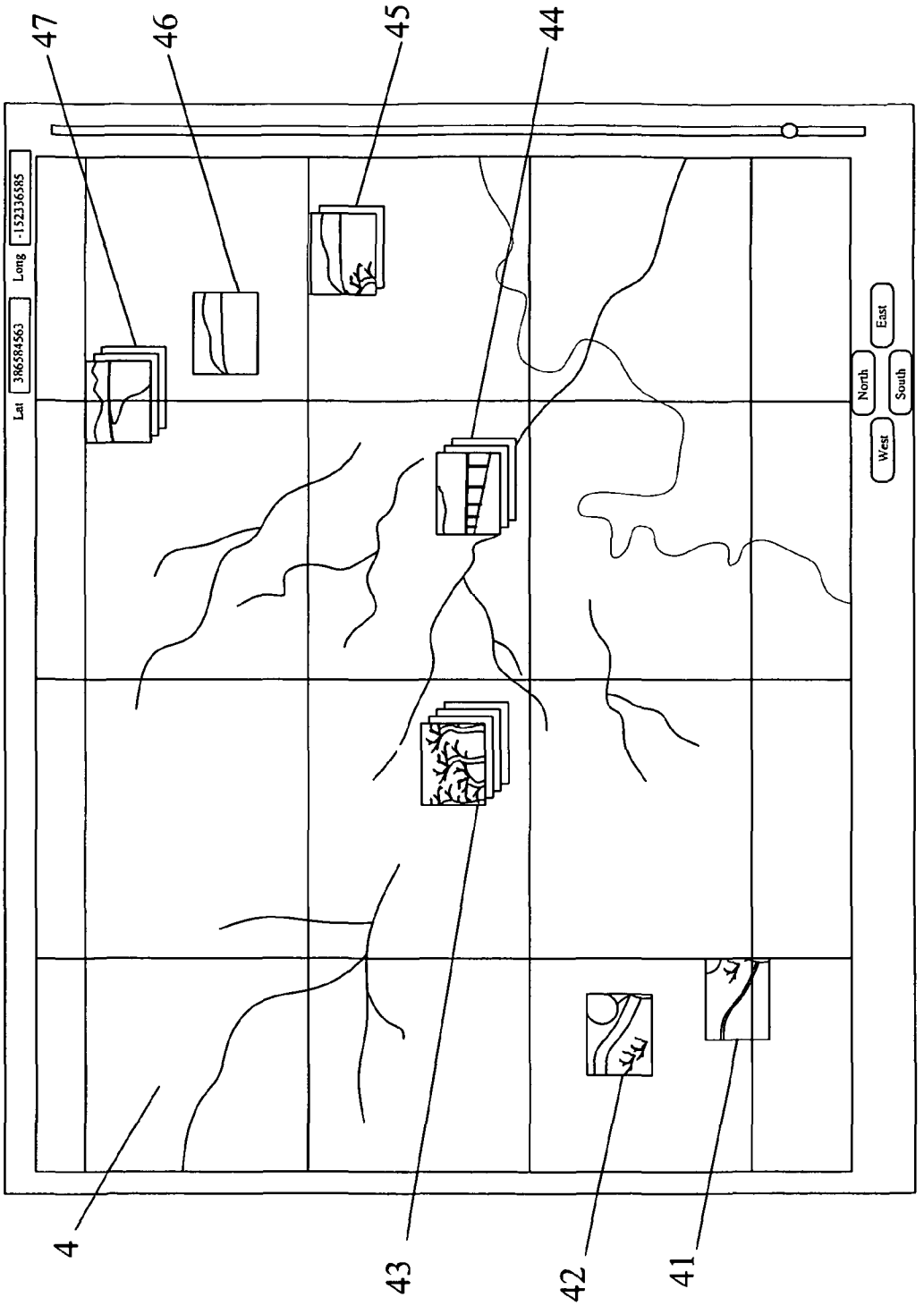
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FIG.4A

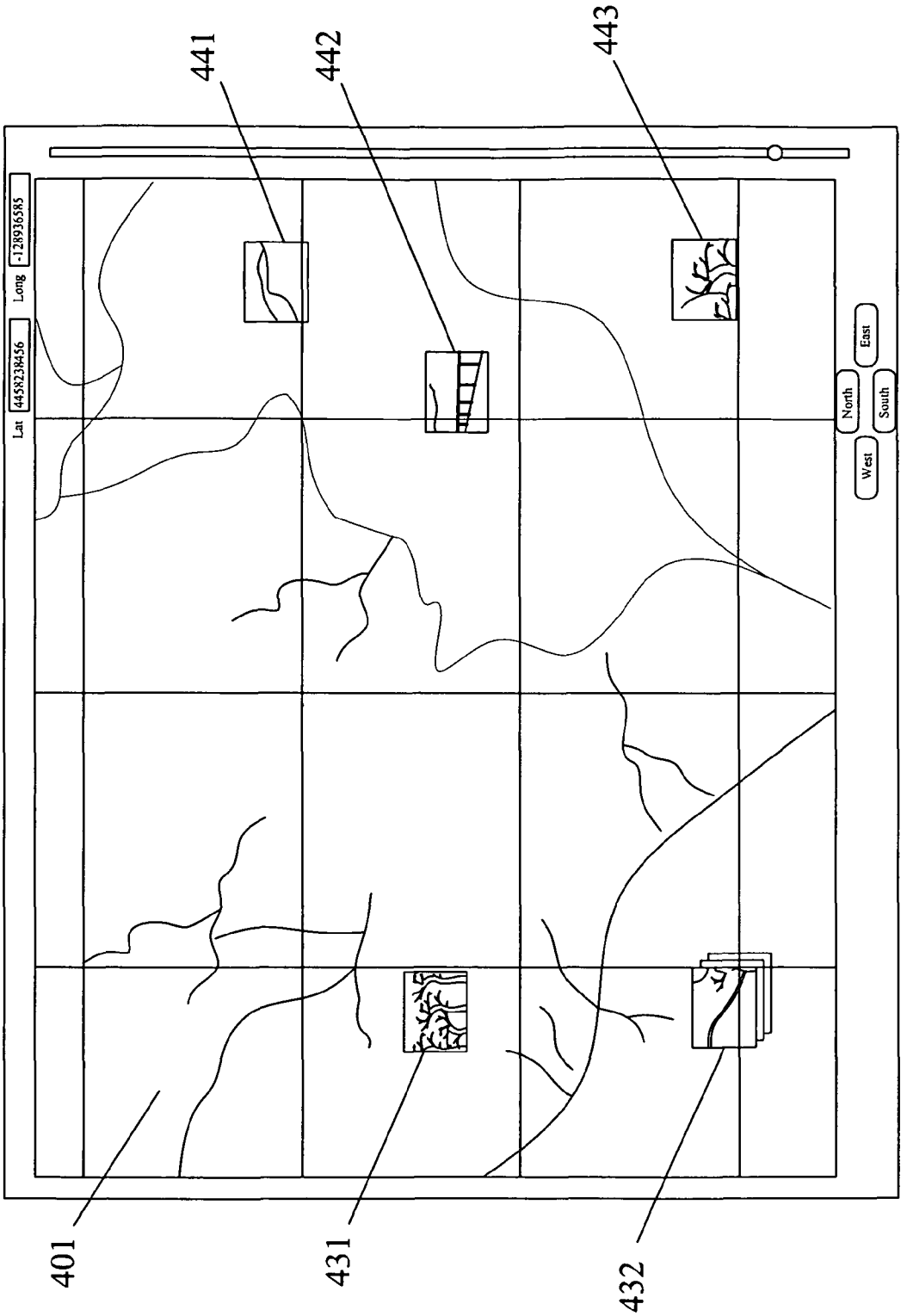
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FIG.4B

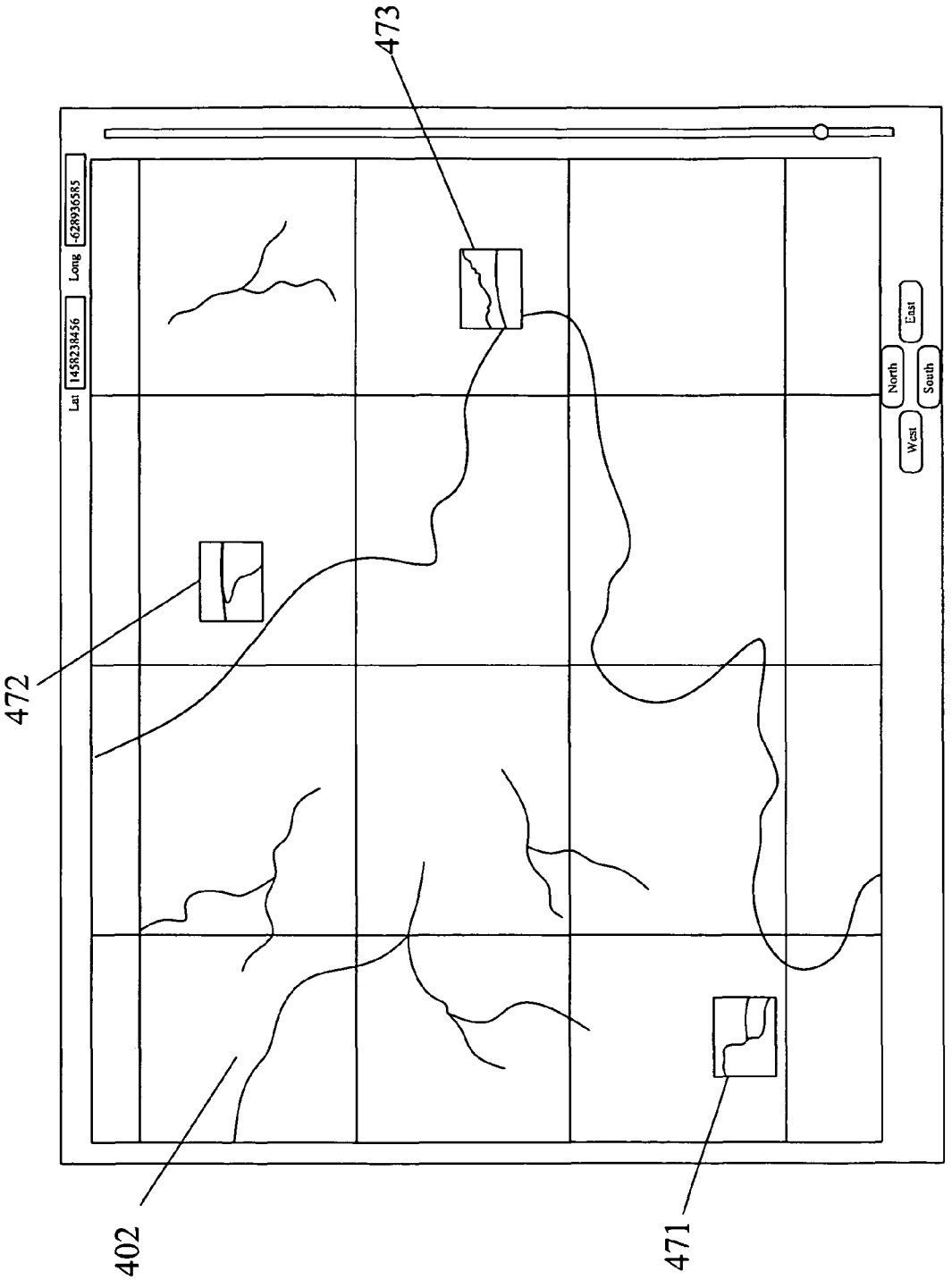
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FIG.4C

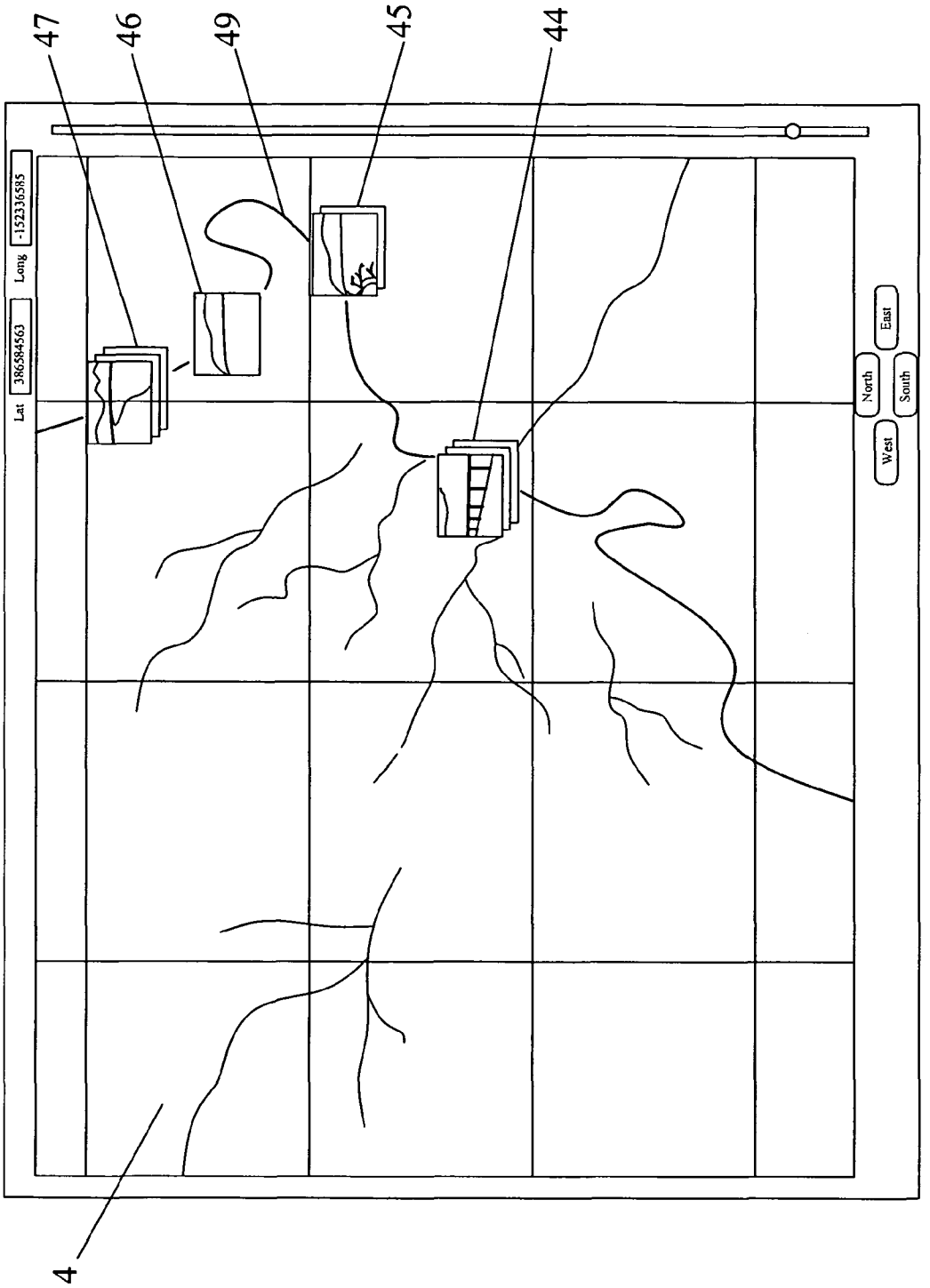
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FIG.4D

METHOD OF DISPLAYING PICTURE HAVING LOCATION DATA AND APPARATUS THEREOF

FIELD OF THE INVENTION

The invention is related to a picture display method and apparatus thereof, and more particularly to a method of displaying picture having location information and apparatus thereof.

BACKGROUND OF THE INVENTION

The traditional method of displaying picture is arranging the pictures by filenames, established dates, file size or file class. However, it is not convenient for a user to display the picture captured in trip. When traveler takes pictures on the trip, he/she usually wants to show the scenery to his/her family or friends by the pictures and tell them where the pictures are taken based on an electronic map. Many image capture apparatus capable of storing the location data into the captured picture are developed, for example, camera combined with the GPS module. What is needed is how to display picture in an efficient way and a meaningful way.

Presently, many travel-guide web sites provide a simple link function to display several pictures when the user clicks the certain tags. Moreover, the iPhone of the Apple company and the application software of the GeoSpatialExperts company also provide the function that display pictures on an electronic map.

But the traditional technology mentioned above must compile the pictures with the electronic map in advance before displaying these pictures and map. The display size of pictures can not adjust in real time when the user zooms in/out the electronic map. In other words, the pictures can't be adjusted automatically when the user adjusts the scale of the electronic map. Therefore, the pictures also can't be recognized clearly and be separated by their location precisely at the same time.

In view of the drawbacks of the traditional art, the inventor of the present invention based on years of experience in the related industry to conduct extensive researches and experiments, and finally developed a method of displaying picture having location data and apparatus thereof in accordance with the present invention to overcome the aforementioned drawbacks.

SUMMARY OF THE INVENTION

It is therefore one of objective of the present invention is to provide a method of displaying picture having location data and apparatus thereof, for improving the efficiency of picture display and management.

Another objective of the present invention is to provide a method of displaying picture having location data and apparatus thereof, for automatically adjusting the display locations of the thumbnails on the electronic map based on the scale of the electronic map.

Another objective of the present invention is to provide a method of displaying picture having location data and apparatus thereof, for recognizing the adjacent thumbnails of which clearly

In a first aspect, the invention consists in a method of displaying picture having location data, the method comprises the steps of:

i) providing an electronic map and a plurality of pictures having location data, and

ii) generating a plurality of thumbnails corresponding to the pictures based on a scale, and

iii) displaying the thumbnails on the electronic map based on the location data of corresponding picture of each thumbnail, and

iv) overlappingly displaying the thumbnails of which the distance between said thumbnails is shorter than a threshold.

Preferably, the method further comprises a step of relocating said thumbnails on said zoomed electronic map based on said location data of corresponding picture of each thumbnail when said electronic map is zoomed in/out.

Preferably, the method further comprises a step of relocating said thumbnails on said zoomed electronic map based on said location data of corresponding picture of each thumbnail when said electronic map is zoomed in/out.

Preferably, the method further comprises a step of defining said thumbnails of which the distance between each other is shorter than said threshold value as a thumbnail group.

Preferably, the method further comprises a step of zooming in said electronic map and relocating said thumbnails of said thumbnail group on said zoomed electronic map when said thumbnail group is triggered.

Preferably, the thumbnail can hyperlink to the corresponding pictures when the thumbnail is triggered.

Preferably, the location data can contain longitude and latitude data.

Preferably, the location data can contain address data.

Preferably, the picture also contains a correlation data.

Preferably, the method further comprises a step of selecting said pictures which are desired to display based on the correlation data.

Preferably, correlation data can be a trip data.

Preferably, electronic map is vector based or image based.

Preferably, the image based electronic map can be a satellite photo with the longitude and latitude data.

In a further aspect, the present invention consists in a picture display apparatus comprising:

a storage unit for storing an electronic map and a plurality of pictures having location data;

a display unit; and

a processing unit for generating a plurality of thumbnails corresponding to said pictures based on a scale, and driving said display unit to display said thumbnails on said electronic map based on said location data of corresponding picture of each thumbnail and overlappingly display the thumbnails of which the distance between said plurality of thumbnails is shorter than a threshold value on said electronic map.

Preferably, the picture display apparatus further comprises an input unit, and when a user operates the picture display apparatus to zoom in/out the electronic map by the input unit, the processing unit relocates said thumbnails on the zoomed electronic map based on the location data of corresponding picture of each thumbnail.

Preferably, the processing unit defines the thumbnails of which the distance between each other is shorter than the threshold value as a thumbnail group.

Preferably, when the user triggers one thumbnail group by said input unit, the processing unit zooms in the electronic map and relocating the thumbnails of the triggered thumbnail group on the zoomed electronic map.

Preferably, when the user triggers a thumbnail by the input unit, the processing unit drives the display unit to display the corresponding picture.

Preferably, the location data can contain longitude and latitude data.

Preferably, the location data can contain address data.

Preferably, the picture also contains a correlation data.

Preferably, the processing unit selects the pictures which are desired to display based on the correlation data.

Preferably, correlation data can be a trip data.

Preferably, electronic map is vector based or image based.

Preferably, the image based electronic map can be a satellite photo with the longitude and latitude data.

In a further aspect, the invention consists in a method of displaying picture having location data, the method comprises the steps of:

i) providing an electronic map and a plurality of pictures having location data, and

ii) generating a plurality of thumbnails corresponding to the pictures based on a scale, and

iii) displaying the thumbnails on the electronic map based on the location data of corresponding picture of each thumbnail, and

iv) relocating the thumbnails on the zoomed electronic map based on the location data of corresponding picture of each thumbnail when the electronic map is zoomed in/out.

Preferably, the method further comprises a step of overlappingly displaying the thumbnails of which the distance between the thumbnails is shorter than a threshold on said electronic map.

Preferably, the method further comprises a step of defining said thumbnails of which the distance between each other is shorter than said threshold value as a thumbnail group.

Preferably, the method further comprises a step of zooming in said electronic map and relocating said thumbnails of said thumbnail group on said zoomed electronic map when said thumbnail group is triggered.

Preferably, the thumbnail can hyperlink to the corresponding pictures when the thumbnail is triggered.

Preferably, the location data can contain longitude and latitude data.

Preferably, the location data can contain address data.

Preferably, the picture also contains a correlation data.

Preferably, the method further comprises a step of selecting said pictures which are desired to display based on the correlation data.

Preferably, correlation data can be a trip data.

Preferably, electronic map is vector based or image based.

Preferably, the image based electronic map can be a satellite photo with the longitude and latitude data.

This invention may also be said broadly to consist in the parts, elements and features referred to or indicated in the specification of the application, individually or collectively, and any or all combinations of any two or more of said parts, elements or features, and where specific integers are mentioned herein which have known equivalents in the art to which this invention relates, such known equivalents are deemed to be incorporated herein as if individually set forth.

BRIEF DESCRIPTION OF THE DRAWINGS

The subject matter regarded as the invention is particularly pointed out and distinctly claimed in the concluding portion of the specification. The invention, both as to device and method of operation, together with features and advantages thereof may best be understood by reference to the following detailed description with the accompanying drawings in which:

FIG. **1** illustrates a flow diagram illustrating the method of displaying picture having location data in accordance with the preset invention,

FIG. **2** illustrates a block diagram of picture display apparatus in accordance with the preset invention,

FIG. **3** illustrates a block diagram of the embodiment of a picture display apparatus in accordance with the present invention,

FIG. **4**A illustrates a schematic view of an embodiment of display of picture and an electronic map,

FIG. **4**B illustrates a schematic view of an embodiment of display of picture and an electronic map after zooming in,

FIG. **4**C illustrates a schematic view of an embodiment of display of picture and an electronic map after a thumbnail group is triggered, and

FIG. **4**D illustrates a schematic view of an embodiment of display of picture and an electronic map based on a trip data.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention relates to a method of displaying picture having location data and apparatus thereof. While the specifications describe at least one embodiment of the invention considered best modes of practicing the invention, it should be understood that the invention can be implemented in many ways and is not limited to the particular examples described below or to the particular manner in which any features of such examples are implemented.

FIG. **1** illustrates a flow diagram of the method of displacing picture having location data of the present invention. In step **11** an electronic map and a plurality of pictures having location data are provided for display. The electronic map can be vector based or image based, and the image based electronic map may be provided as for example, a satellite photo with the longitude and latitude data. Preferably, the picture is the JPEG file embedded with EXIF GPS tags which contains longitude and latitude data of location where the JPEG file is captured, wherein EXIF is the abbreviated name of Extendible Image Format. Preferably, the picture further contains a correlation data, such as trip data.

In step **12** a plurality of thumbnails corresponding to the pictures are generated based on a scale. Preferably, the picture desired to display is scaled down to generate a corresponding thumbnail, and the viewer can recognize the content of the picture roughly by viewing the thumbnail. In step **13** the thumbnails are displayed on the electronic map based on the location data of corresponding picture of each thumbnail.

In step **14** the thumbnails of which the distance between each other is shorter than a threshold are overlappingly displayed on the electronic map. The distance can be the pixel distance between the displayed locations of two thumbnails and the threshold can be a minimum pixel distance between two thumbnails for clear viewing. The thumbnails overlappingly displayed can be defined as a thumbnail group, and the pictures in the same group can be selected or operated at the same time. Therefore, the thumbnails close together will be displayed overlappingly as a stack, so that the viewer can have better experience in viewing the map with thumbnails.

When the electronic map is zoomed in/out, the thumbnails will be relocated on the zoomed electronic map based on the location data of corresponding picture of each thumbnail in step **15**. Preferably, when the thumbnail group is triggered, the electronic map is zoomed in to approximately relocate these thumbnails of the thumbnail group on the zoomed electronic map. Preferably, a thumbnail can be triggered to hyperlink to the corresponding picture.

Preferably, the pictures which are desired to display are selected based on the correlation data contained in the picture.

FIG. **2** illustrates a schematic block diagram of a picture display apparatus in accordance with the present invention. The picture display apparatus **2** may comprise a storage unit

21, a display unit 22 and a processing unit 23. The storage unit 21 is for storing an electronic map 24 and a plurality of pictures 25 having location data 251. The electronic map 24 can be vector based or image based, and the image based electronic map may be provided as for example, a satellite photo with the longitude and latitude data. Preferably, the picture 25 is the JPEG file embedded with EXIF GPS tags which contains longitude and latitude data of location where the JPEG file is captured, wherein EXIF is the abbreviated name of Extendible Image Format. Preferably, the picture 25 further contains a correlation data, such as trip data.

The processing unit 23, such as microcontroller or microprocessor, is for generating a plurality of thumbnails 26 corresponding to the pictures 25 based on a scale. Preferably, processing unit 23 scales down the picture desired to display to generate a corresponding thumbnail 26, and the viewer can recognize the content of the picture 25 roughly by viewing the thumbnail 26. Preferably, the scale of the thumbnails can be a predetermined value or decided by the user.

Then the processing unit 23 drives the display unit 22 to display the thumbnails 26 on the electronic map 24 based on the location data 251 of corresponding picture of each thumbnail 26 and overlappingly display the thumbnails 26 of which the distance between said plurality of thumbnails 26 is shorter than a threshold on the electronic map 24. The distance can be the pixel distance between the displayed locations of two thumbnails and the threshold can be a minimum pixel distance between two thumbnails for clear viewing. The thumbnails close together are displayed overlappingly as a stack, so that the viewer can have better experience in viewing the map with thumbnails

Besides, the processing unit 23 can defines the thumbnails overlappingly displayed together as a thumbnail group. The pictures in the same group can be selected or operated at the same time

If the picture 25 further contains a correlation data, such as trip data, the processing unit 23 can select the pictures which are desired to display based on the correlation data.

Preferably, the picture display apparatus 2 can further comprises an input unit which may alternatively be provided as for example, at least one button, a keypad, a touch pad or a mouse.

Preferably, when the thumbnail group is triggered, for example, a user operates the mouse to double click the thumbnail group, and the processing unit zooms in the electronic map to approximately relocate these thumbnails of the thumbnail group on the zoomed electronic map.

Preferably, a thumbnail can be triggered to hyperlink to the corresponding picture.

Preferably, the display unit 22 comprises a display panel and a display control unit with image buffer memory.

Preferably, the storage unit 21 comprises an ROM, an RAM, a flash memory or a hard disk.

Preferably, the picture display apparatus 2 can further comprises a networking unit for downloading the electronic map.

FIG. 3 illustrates a schematic block diagram of the embodiment of a picture display apparatus in accordance with the present invention. The picture display apparatus 3 may comprise a hard disk 31, a display panel 321, a display control unit 322, image buffer memory 323, a microprocessor 33, a networking unit 391 and a touch pad 392. The hard disk 31 is for storing at least one satellite photo 34 and JPEG files 35 embedded with EXIF GPS tags 351 which contains longitude and latitude data of JPEG files 35. The satellite photo 34 can be stored in advance or downloaded from a remote server in real time by the networking unit 391 when the user wants to display these JPEG files 35.

The microprocessor 33 fetches the satellite photo 34 from hard disk 31 and decodes the satellite photo 34 for obtaining the image raw data contained in satellite photo 34, and then the microprocessor 33 transforms the resolution of image raw data to match the size of the image buffer memory 323 and copies the transformed image raw data 381 to the image buffer memory 323.

The microprocessor 33 then fetches the JPEG file 35 which is desired to display from hard disk 31 and decodes JPEG files 35 for obtaining the image raw data contained in the JPEG files 35, and generates a corresponding thumbnail by reducing the resolution of the image raw data. Preferably, the viewer can recognize the content of the JPEG file 35 roughly by viewing the thumbnail.

The microprocessor 33 calculates pixel location of the thumbnail based on longitude and latitude data of the JPEG file 35 and longitude and latitude data of satellite photo 34. After calculating all pixel location of thumbnails corresponding to the JPEG files 35 which are desired to display, the microprocessor 33 compares the distances between pixel locations of thumbnails with a threshold. The threshold can be a minimum pixel distance between two thumbnails for clear viewing.

If the distance between pixel locations of two thumbnails is smaller than the threshold, these two thumbnails may not be recognized clearly while being displayed on the satellite photo 34, so the microprocessor 33 defines the thumbnails of which the distance between said plurality of thumbnails is shorter than the threshold as a thumbnail group and overlaps these thumbnails in stack to generate the image raw data of thumbnail group.

The microprocessor 33 then copies the image raw data 382 of the thumbnail or thumbnail group to the image buffer memory 323 based on its pixel location. Over a predefined period of time, such as 33.3 ms or 16.6 ms, the display control unit 322 transforms the data stored in the image buffer memory 323 into electric signal which is then transmitted to the display panel 321 for display, as shown in FIG. 4A which illustrates a schematic view of an embodiment of display of picture and an electronic map. In FIG. 4A, there are three thumbnails (41, 42, and 45) and four thumbnail groups (43, 44, 45, and 47) displayed on a satellite photo 4.

When the user operates the picture display apparatus 3 to zoom in/out the displayed satellite photo 34 by the touch pad 392, the microprocessor 33 re-transforms the resolution of image raw data of satellite photo 34 based on inputted scale. If the resolution of the transformed image raw data is higher than the image buffer memory 323, the microprocessor 33 selects a matching area for the image buffer memory 323 in the transformed image raw data and copies the image raw data 381 in the matching area from the transformed image raw data to the image buffer memory 323 for display.

The microprocessor 33 then re-calculates pixel location of the thumbnail based on longitude and latitude data of the JPEG file 35, longitude and latitude data of satellite photo 34, and the size and the pixel location of the matching area. After calculating all pixel location of thumbnails corresponding to the JPEG files 35 which are desired to display, the microprocessor 33 repeats the comparing process mentioned above to determined which thumbnail is overlapping displayed.

The microprocessor 33 then copies the image raw data 382 of the thumbnail or thumbnail group to the image buffer memory 323 based on its pixel location for display, as shown in FIG. 4B which illustrates a schematic view of an embodiment of display of picture and an electronic map after zoom-

ing in. In FIG. **4**B, there are four thumbnails (**431**, **441**, **442**, and **443**) and one thumbnail group **432** displayed on a transformed satellite photo **401**.

Therefore, when the displayed satellite photo **34** is zoomed in/out, only the display locations of the thumbnails changes or several thumbnails are displayed overlappingly, and the display size of the thumbnails will not change.

When the user triggers one thumbnail group by the touch pad **392**, microprocessor **33** re-transforms the resolution of image raw data of satellite photo **34** for clearly displaying thumbnails of the triggered thumbnail group without any thumbnail being overlappingly displayed. The microprocessor **33** then selects a matching area for the image buffer memory **323** in the transformed image raw data and copies the image raw data **381** of the matching area from the transformed image raw data to the image buffer memory **323** for display. The microprocessor **33** repeats the pixel location calculating process mentioned above and copies the image raw data **382** of the thumbnails to the image buffer memory **323** based on its pixel location for display, as shown FIG. **4**C which illustrates a schematic view of an embodiment of display of picture and an electronic map after a thumbnail group **47** is triggered. In FIG. **4**C, there are three thumbnail (**471**, **472**, and **473**) displayed on the transformed satellite photo **402**.

Preferably, the thumbnail can be triggered to hyperlink to the corresponding JPEG files **35**. When the user triggers one thumbnail by the touch pad **392**, the picture display apparatus **3** may display the corresponding JPEG files **35** in larger size or full screen for clearly viewing.

Besides, if the tags **351** embedded in JPEG files **35** contain a correlation data, such as a trip data, microprocessor **33** can select the JPEG file **35** containing the trip data selected by the user, and only the thumbnails of the selected JPEG files **35** are displayed on the satellite photo. Preferably, the route of the trip data selected by the user is also displayed on the satellite photo **34**, as shown in FIG. **4**D. In FIG. **4**D, there are one route **49**, one thumbnail **46** and three thumbnail groups (**44**, **45**, and **47**) displayed on the satellite photo **4**, without thumbnail **41**, **42** and thumbnail group **43**. Comparing to FIG. **4**A, FIG. **4**D can be displayed in a meaningful way for the traveler.

While the present invention has been described by way of example and in terms of a preferred embodiment, it is to be understood that the present invention is not limited thereto. To the contrary, it is intended to cover various modifications and similar arrangements and procedures, and the scope of the appended claims therefore should be accorded the broadest interpretation so as to encompass all such modifications and similar arrangements and procedures.

What is claimed is:

1. A method of displaying picture having location data, comprising the steps of:

providing an electronic map and a plurality of pictures having location data;

generating a plurality of thumbnails corresponding to said pictures based on a scale;

displaying said thumbnails on said electronic map based on said location data of corresponding picture of each thumbnail; and

overlappingly displaying said thumbnails of which the distance between said thumbnails is shorter than a threshold on said electronic map.

2. The method of claim **1**, further comprising a step of relocating said thumbnails on said zoomed electronic map based on said location data of corresponding picture of each thumbnail when said electronic map is zoomed in/out.

3. The method of claim **1**, further comprising a step of defining said thumbnails of which the distance between each other is shorter than said threshold value as a thumbnail group.

4. The method of claim **3**, further comprising a step of zooming in said electronic map and relocating said thumbnails of said thumbnail group on said zoomed electronic map when said thumbnail group is triggered.

5. The method of claim **1**, wherein said thumbnail can be triggered to hyperlink to said corresponding picture.

6. The method of claim **1**, wherein said location data comprises longitude and latitude data.

7. The method of claim **1**, wherein said picture further comprises a correlation data.

8. The method of claim **7**, further comprising a step of selecting said pictures which are desired to display based on said correlation data.

9. The method of claim **8**, wherein said correlation data is a trip data.

10. The method of claim **1**, wherein said electronic map is vector based or image based.

11. The method of claim **10**, wherein the image based electronic map can be a satellite photo with the longitude and latitude data.

12. A picture display apparatus, comprising:

a storage unit, for storing an electronic map and a plurality of pictures having location data;

a display unit; and

a processing unit, for generating a plurality of thumbnails corresponding to said pictures based on a scale, and driving said display unit to display said thumbnails on said electronic map based on said location data of corresponding picture of each thumbnail and overlappingly display said thumbnails of which the distance between said thumbnails is shorter than a threshold value on said electronic map.

13. The picture display apparatus of claim **12**, further comprising an input unit, wherein said processing unit relocates said thumbnails on said zoomed electronic map based on said location data of corresponding picture of each thumbnail when a user operates said picture display apparatus to zoom in/out said electronic map by said input unit.

14. The picture display apparatus of claim **12**, wherein said processing unit defines said thumbnails of which the distance between each other is shorter than said threshold value as a thumbnail group.

15. The picture display apparatus of claim **14**, wherein said processing unit zooms in said electronic map and relocating said thumbnails of said thumbnail group on said zoomed electronic map when said user triggers said thumbnail group by said input unit.

16. The picture display apparatus of claim **12**, wherein processing unit drives said display unit to display said corresponding picture when said user triggers said thumbnail by said input unit.

17. The picture display apparatus of claim **12**, wherein said location data comprises longitude and latitude data.

18. The picture display apparatus of claim **12**, said picture further comprises a correlation data.

19. The picture display apparatus of claim **18**, said processing unit selects said pictures which are desired to display based on said correlation data.

20. The picture display apparatus of claim **18**, wherein said correlation data is a trip data.

21. The picture display apparatus of claim **12**, wherein said electronic map is vector based or image based.

22. The picture display apparatus of claim 21, wherein the image based electronic map can be a satellite photo with the longitude and latitude data.

23. A method of displaying picture having location data, comprising the steps of:

providing an electronic map and a plurality of pictures having location data;

generating a plurality of thumbnails corresponding to said pictures based on a scale;

displaying said thumbnails on said electronic map based on said location data of corresponding picture of each thumbnail;

relocating said thumbnails on said zoomed electronic map based on said location data of corresponding picture of each thumbnail when said electronic map is zoomed in/out; and

overlappingly displaying said thumbnails of which the distance between said thumbnails is shorter than a threshold on said electronic map.

24. The method of claim 23, further comprising a step of defining said thumbnails of which the distance between each other is shorter than said threshold value as a thumbnail group.

25. The method of claim 24, further comprising a step of zooming in said electronic map and relocating said thumbnails of said thumbnail group on said zoomed electronic map when said thumbnail group is triggered.

26. The method of claim 23, wherein said thumbnail can be triggered to hyperlink to said corresponding picture.

27. The method of claim 23, wherein said location data comprises longitude and latitude data.

28. The method of claim 23, wherein said picture further comprises a correlation data.

29. The method of claim 28, further comprising a step of selecting said pictures which are desired to display based on said correlation data.

30. The method of claim 29, wherein said correlation data is a trip data.

31. The method of claim 23, wherein said electronic map is vector based or image based.

32. The method of claim 31, wherein the image based electronic map can be a satellite photo with the longitude and latitude data.

* * * * *

Exhibit B

US008249804B2

(12) **United States Patent**
Lokshin et al.

(10) **Patent No.: US 8,249,804 B2**
(45) **Date of Patent: Aug. 21, 2012**

(54) **SYSTEMS AND METHODS FOR SMART CITY SEARCH**

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(52) **U.S. Cl.** **701/424**

(58) **Field of Classification Search** 701/200, 701/201, 202, 204, 206, 207, 208, 209, 210, 701/211; 707/713, 721, 723; 340/990, 995
See application file for complete search history.

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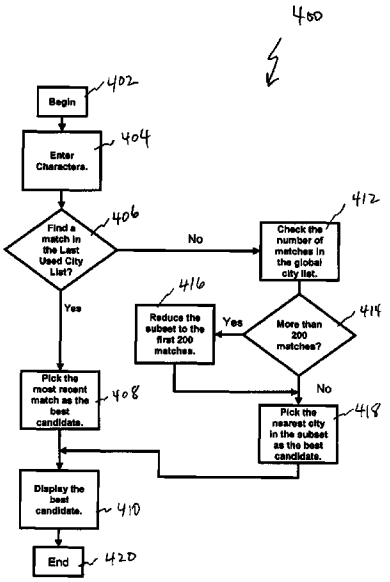
(57) **ABSTRACT**

A method, machine-readable medium, and system involve receiving user input with a navigation device regarding a desired city name. A determination is made regarding whether the user input matches city names in a Last Used City List (LUCL). A Global City List (GCL) is consulted when the user input does not match the city names in the LUCL. A matching city name is selected as a best candidate.

18 Claims, 6 Drawing Sheets



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USPTO Transaction History of related U.S. Appl. No. 10/208,261, filed Jul. 31, 2002, entitled "Displaying Data," now U.S. Patent No. 6,748,323.
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USPTO Transaction History of related U.S. Appl. No. 11/684,301, filed Mar. 9, 2007, entitled "Method and Apparatus for Determining a Route Having an Estimated Minimum Fuel Usage for a Vehicle."
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USPTO Transaction History of related U.S. Appl. No. 11/844,321, filed Aug. 23, 2007, entitled "Rerouting in Vehicle Navigation Systems."
USPTO Transaction History of related U.S. Appl. No. 11/852,973, filed Sep. 10, 2007, entitled "Nearest Neighbor Geographic Search."
USPTO Transaction History of related U.S. Appl. No. 11/906,277, filed Oct. 1, 2007, entitled "Static and Dynamic Contours."
USPTO Transaction History of related U.S. Appl. No. 11/945,211, filed Nov. 26, 2007, entitled "System and Method of Providing Traffic Data to a Mobile Device."
USPTO Transaction History of related U.S. Appl. No. 11/967,889, filed Jan. 1, 2008, entitled "System and Method for Accessing a Navigation System."
USPTO Transaction History of related U.S. Appl. No. 12/013,384, filed Jan. 11, 2008, entitled "System and Method to Provide Navigational Assistance Using an Online Social Network."
USPTO Transaction History of related U.S. Appl. No. 12/016,949, filed Jan. 18, 2008, entitled "Method and Apparatus for Hybrid Routing Using Breadcrumb Paths."

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USPTO Transaction History of related U.S. Appl. No. 12/016,982, filed Jan. 18, 2008, entitled "Method and Apparatus for Access Point Recording Using a Position Device."
USPTO Transaction History of related U.S. Appl. No. 12/188,139, filed Aug. 7, 2008, entitled "System and Method to Record a Present Trip."

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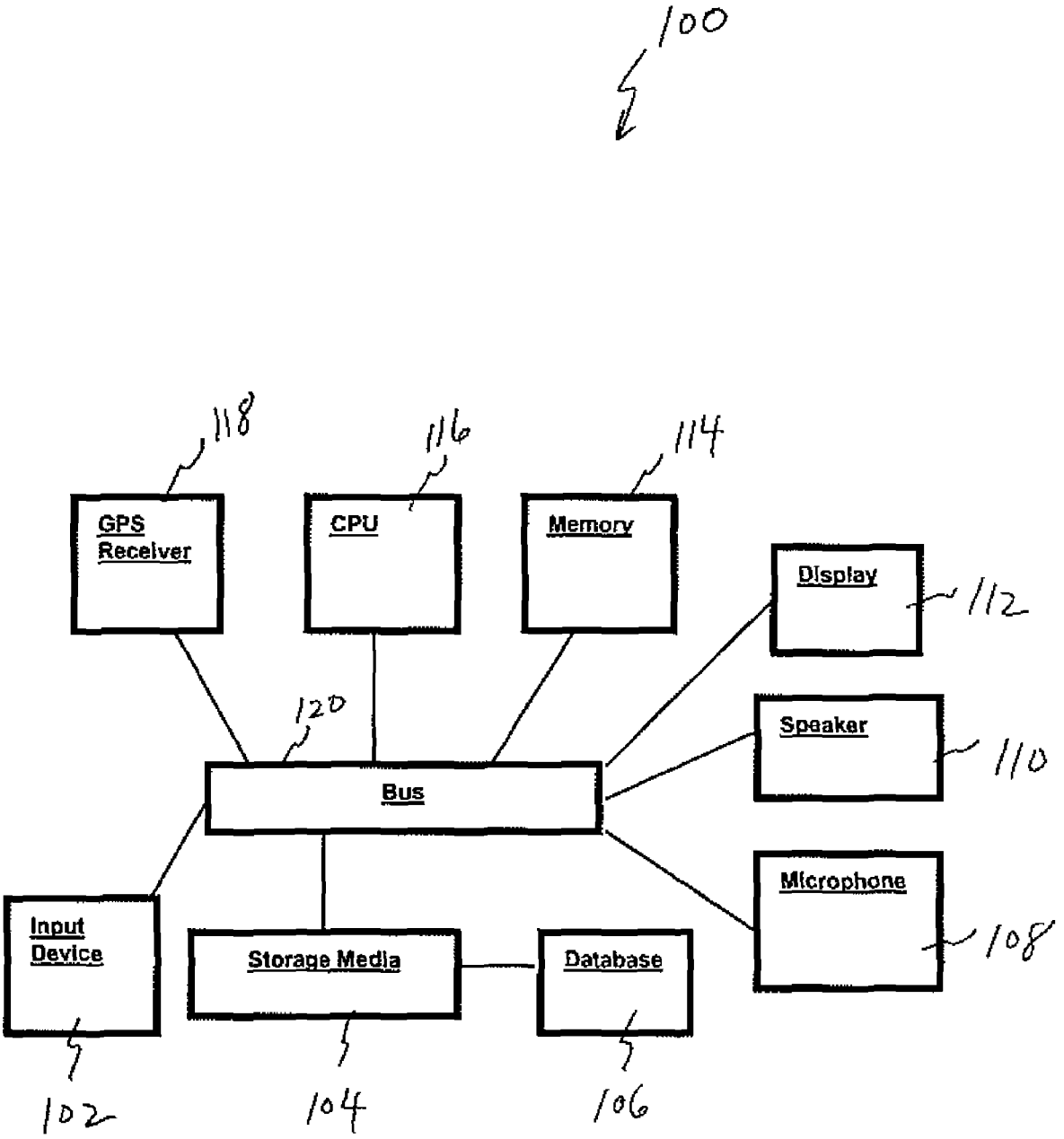
100
118
116
114
GPS Receiver
CPU
Memory
Display
112
120
Speaker
110
Bus
Microphone
108
Input Device
Storage Media
Database
102
104
106

FIGURE 1

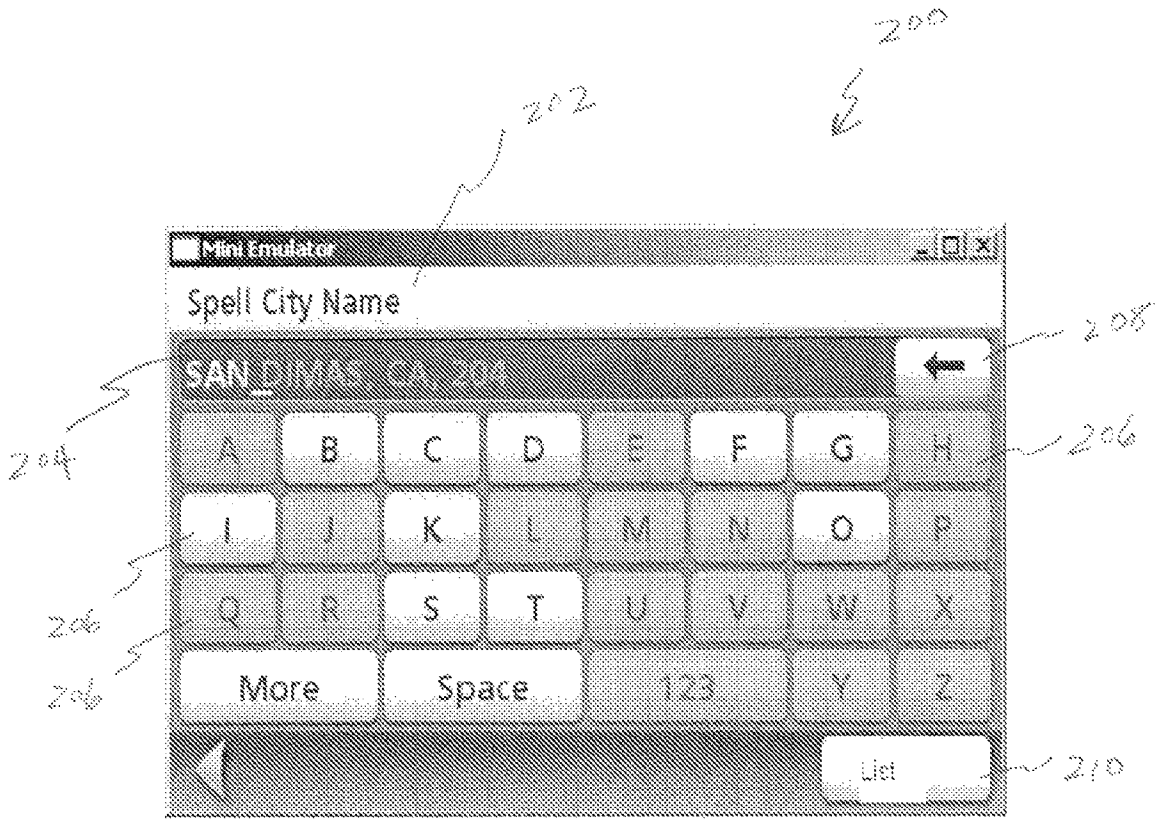
200
202
Mini emulator
Spell City Name
SAN
208
204
A
B
C
D
E
F
G
H
206
I
J
K
L
M
N
O
P
206
Q
R
S
T
U
V
W
X
206
More
Space
123
Y
Z
List
210

FIGURE 2

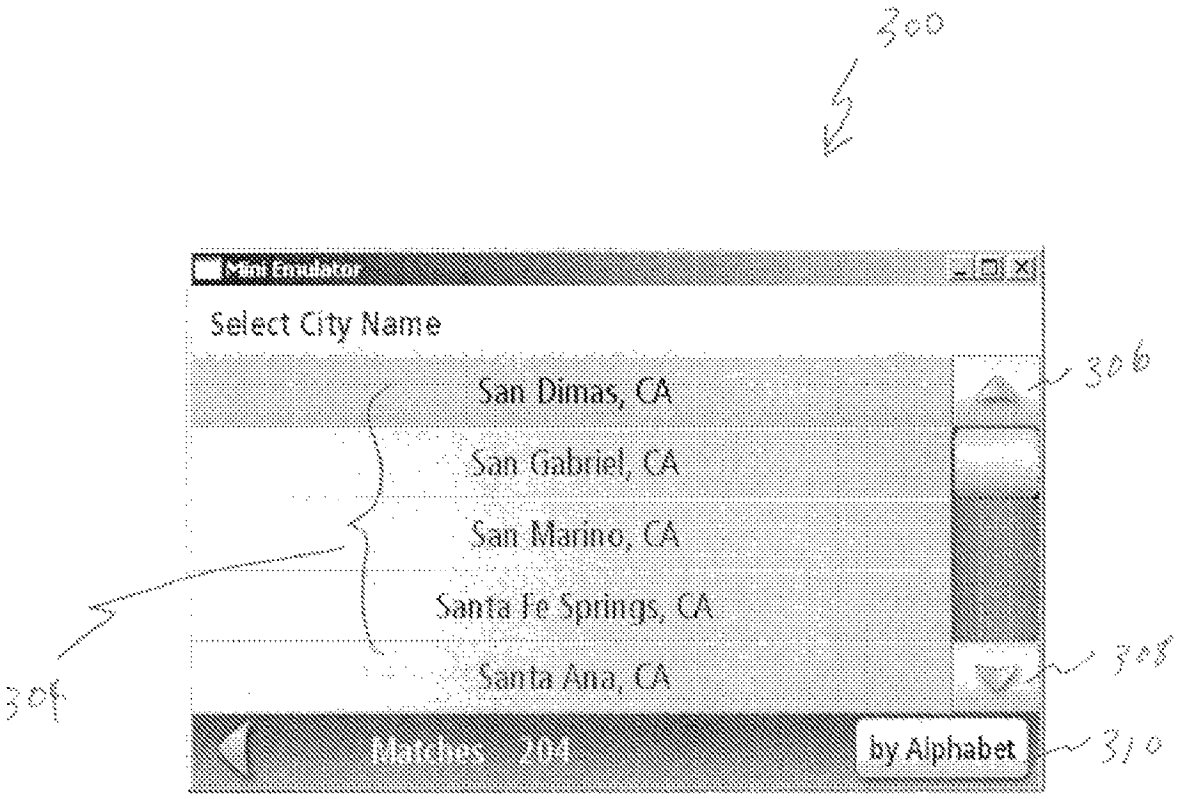
300
Mini Emulator
Select City Name
San Dimas, CA
San Gabriel, CA
San Marino, CA
Santa Fe Springs, CA
Santa Ana, CA
Matches 204
by Alphabet
304
306
308
310

FIGURE 3

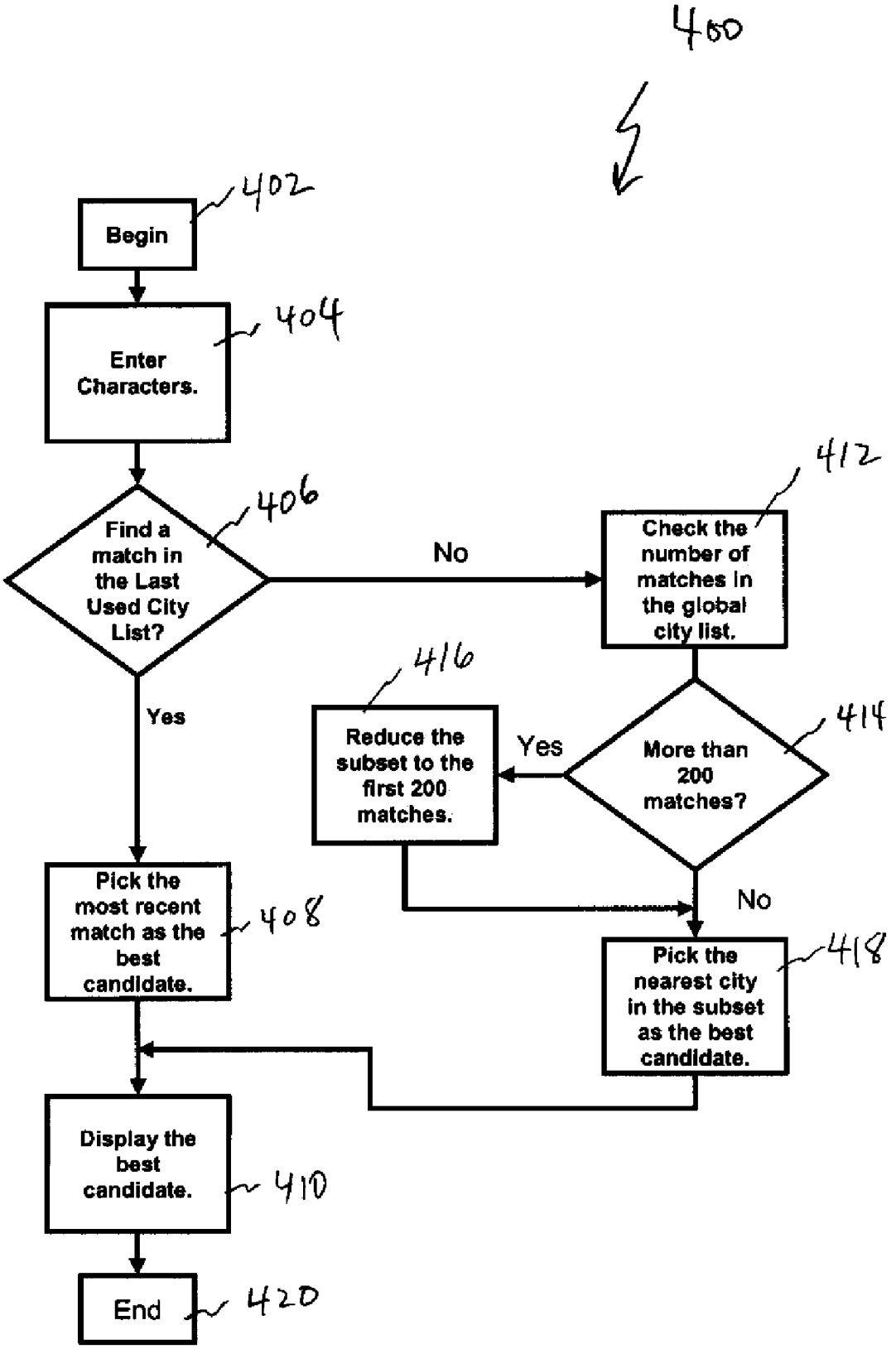
400
402
Begin
404
Enter Characters.
406
Find a match in the Last Used City List?
No
412
Check the number of matches in the global city list.
Yes
416
Reduce the subset to the first 200 matches.
Yes
414
More than 200 matches?
No
408
Pick the most recent match as the best candidate.
418
Pick the nearest city in the subset as the best candidate.
410
Display the best candidate.
420
End

FIGURE 4

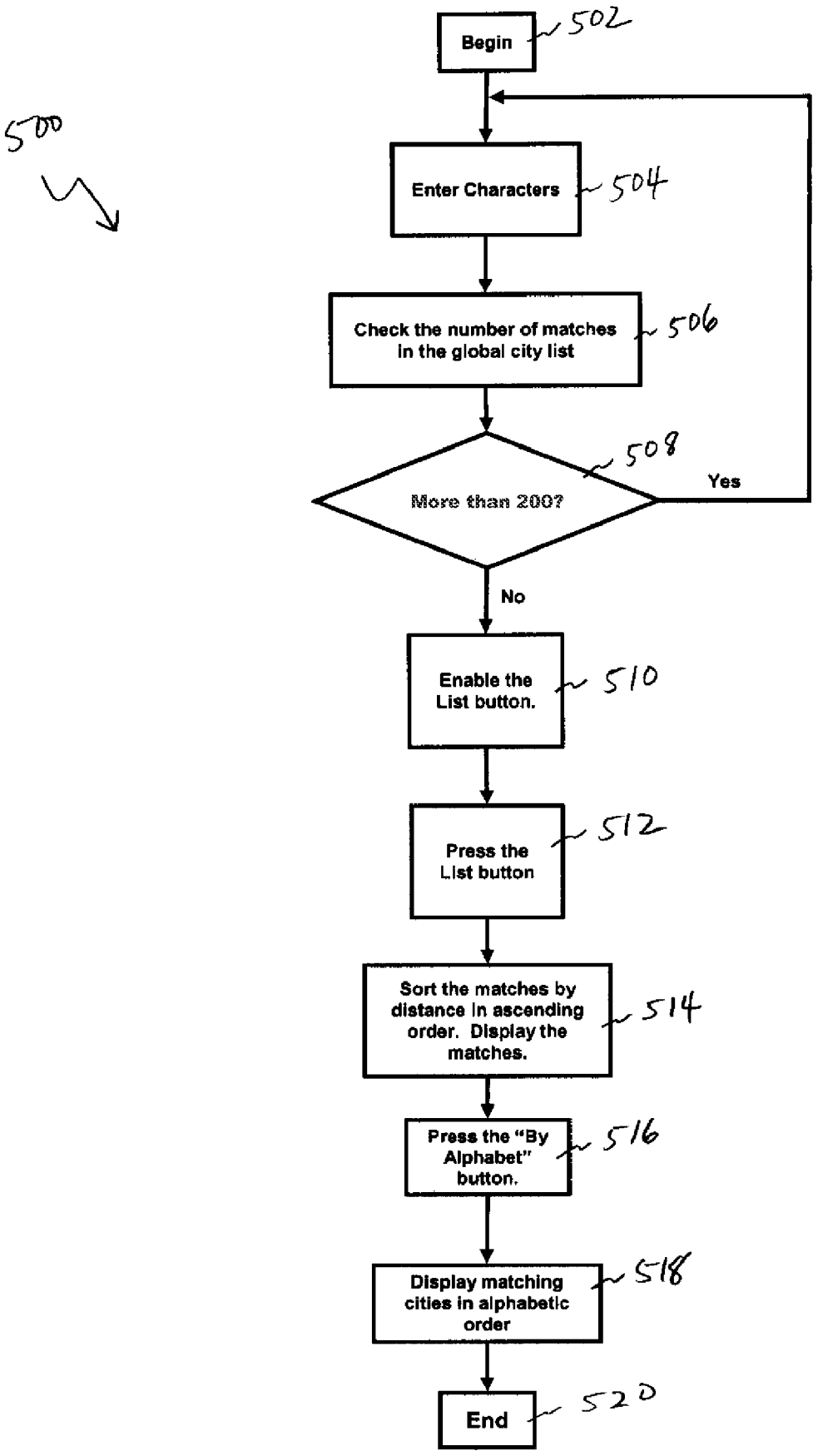
500
Begin
502
Enter Characters
504
Check the number of matches in the global city list
506
More than 200?
508
Yes
No
Enable the List button.
510
Press the List button
512
Sort the matches by distance in ascending order. Display the matches.
514
Press the "By Alphabet" button.
516
Display matching cities in alphabetic order
518
End
520

FIGURE 5

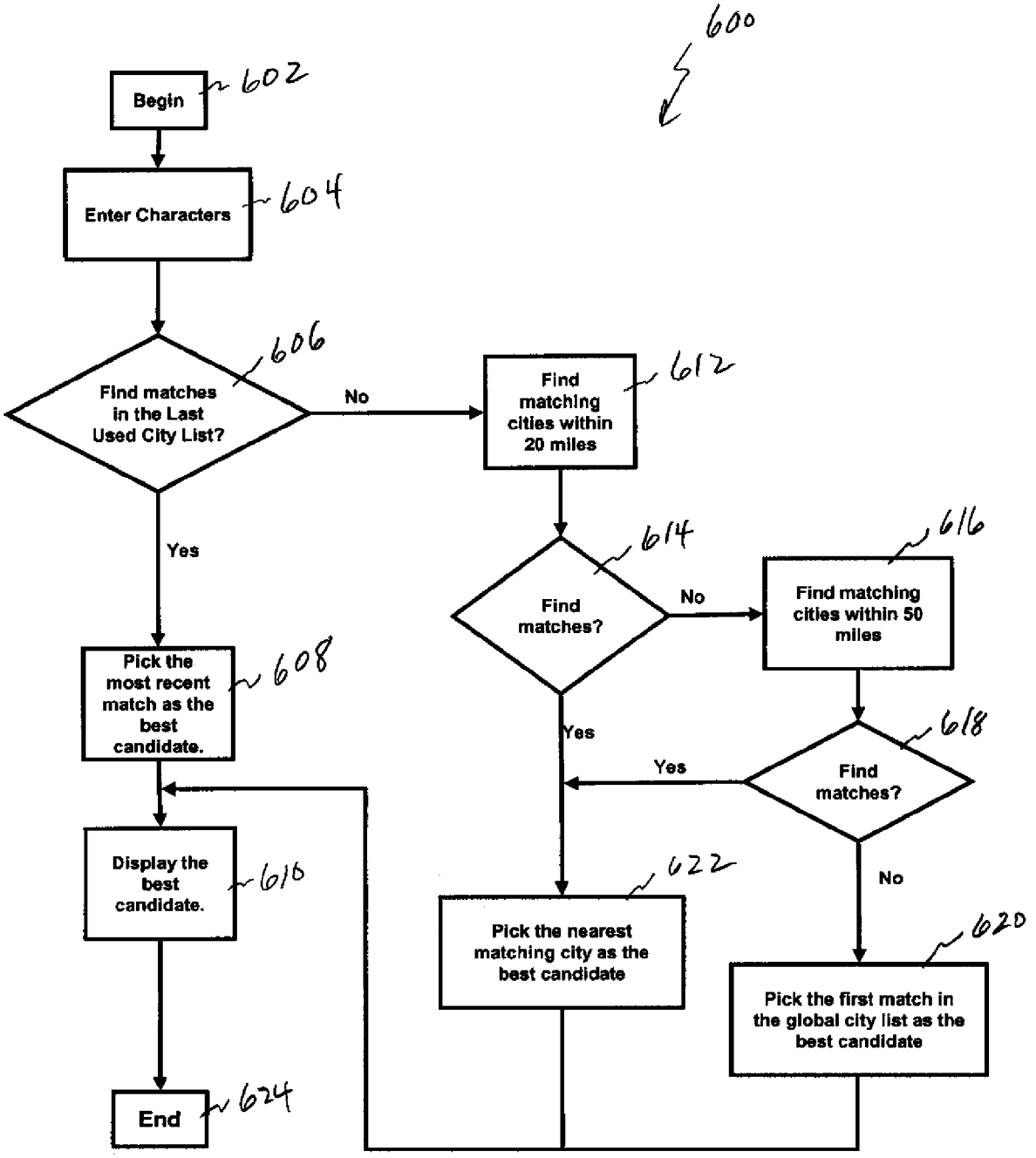
600
Begin
602
Enter Characters
604
Find matches in the Last Used City List?
606
No
Yes
Find matching cities within 20 miles
612
Find matches?
614
No
Yes
Find matching cities within 50 miles
616
Find matches?
618
Yes
No
Pick the most recent match as the best candidate.
608
Display the best candidate.
610
Pick the nearest matching city as the best candidate
622
Pick the first match in the global city list as the best candidate
620
End
624

FIGURE 6

SYSTEMS AND METHODS FOR SMART CITY SEARCH

FIELD OF THE INVENTION

At least some embodiments of the disclosure relate generally to the field of navigation and, more particularly, searching of cities and locations.

BACKGROUND

Global Navigation Satellite Systems (GNSS) allow navigation services including automatic route calculation from a current location to a destination location and guiding a driver of a vehicle to that destination with real time instructions in conjunction with a visual display of route segments as the vehicle progresses along the route.

The satellites transmit signals comprising very precise location parameters and timing signals that are received by mobile device processors allowing a processor to determine their respective three dimensional positions and velocities.

Navigation systems conventionally provide a recommended route from a starting point to a desired destination. Typically, the starting point and desired destination are selected from a large database of roads stored in a mass media storage, such as a CD ROM or SD card, which includes the roads in the area to be traveled by the user. The navigation system can be, for example, located in a personal computer or installed in a vehicle or carried by a pedestrian. If the navigation system is installed in a vehicle, the starting point is typically the current position of the vehicle, which can be input to the navigation system by an associated position determining system that may include a GPS receiver.

The navigation system determines a route from the starting point to the destination. Usually there are many potential routes between the selected starting point and the desired destination. Typical navigation systems select a recommended route based upon certain "cost" values associated with each segment of road in the road database. These cost values include the length of the road segment and the estimated time of travel through the road segment. The navigation system selects the potential route with the lowest total cost to be the recommended route. Depending upon the conventional algorithm of the navigation system, the navigation system may, for example, recommend the route with the shortest total length, the lowest total time, or some weighted average of length and time.

The recommended route then may be displayed to the user as a map showing the starting point and desired destination and highlighting the recommended route. If the navigation system is installed in a vehicle, the navigation system may display the current position of the vehicle and provide turn-by-turn instructions to the driver, guiding the driver to the selected destination.

Navigation systems typically include a graphical user interface that allows a user to input the desired destination. The user often needs to input a city name for the desired destination, for example, as part of the destination address. As another example, the desired destination is a Point of Interest in or near a city. Since a full keyboard is impractical in a vehicle, a conventional graphical user interface includes a touch screen or a directional input device such as a four-way button. The user is presented with the letters of the alphabet arranged in a single large rectangular array, which is usually called soft keyboard. One typical system requires the user to scroll through the alphabet one letter at a time using the directional input device, selecting a desired letter when it becomes highlighted. These systems have the disadvantage of inputting a given letter. With such systems, inputting the city name can also be very time consuming and frustrating for a user.

Many conventional mobile navigation applications allow users to find a city by entering a partial or full city name. Such applications will search for matches in a global city name list sorted alphabetically. All city name matches contain the characters entered by the user as their leading substring. A Next-Letter-Tree (NLT) may be used to support city name entry on the soft keyboard. Because many city names have similar spellings, it usually takes many keystrokes to narrow down the matching cities. The applications may further ask users to pick a city among multiple matches if a partial name is input. Because it is inconvenient for a user to provide inputs to small mobile devices, users want to minimize the number of keystrokes to perform tasks such as locating a desired city.

SUMMARY

A method, machine-readable medium, and system involve receiving a user input with a navigation device regarding a desired city name. A determination is made regarding whether the user input matches city names in a Last Used City List (LUCL). A Global City List (GCL) is consulted when the user input does not match the city names in the LUCL. A matching city name is selected as a best candidate.

BRIEF DESCRIPTION OF THE DRAWINGS

The embodiments are illustrated by way of example and not limitation in the figures of the accompanying drawings in which like references indicate similar elements.

FIG. **1** is a block diagram of a navigation device in accordance with one embodiment of the present invention.

FIG. **2** illustrates an input screen in accordance with one embodiment of the present invention.

FIG. **3** illustrates a list screen in accordance with one embodiment of the present invention.

FIG. **4** is a flow chart of a method to find a best candidate when a city list does not include a spatial index in accordance with one embodiment of the present invention.

FIG. **5** is a flow chart of a method to list matching cities by distance in accordance with one embodiment of the present invention.

FIG. **6** is a flow chart of a method to find a best candidate when a city list includes a spatial index in accordance with one embodiment of the present invention.

DETAILED DESCRIPTION

The following description and drawings are illustrative and are not to be construed as limiting. Numerous specific details are described to provide a thorough understanding of the invention. However, in certain instances, well known or conventional details are not described in order to avoid obscuring the description. References herein to one or an embodiment in the present disclosure can be, but are not necessarily, references to the same embodiment.

Reference in this specification to "one embodiment" or "an embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the disclosure. The appearances of the phrase "in one embodiment" in various places in the specification are not necessarily all referring to the same embodiment, nor are separate or alternative embodiments mutually exclusive of other embodiments. Moreover,

various features are described which may be exhibited by some embodiments and not by others. Similarly, various requirements are described which may be requirements for some embodiments but not other embodiments.

FIG. **1** is a block diagram of a navigation device **100** in accordance with one embodiment of the present invention. In one embodiment, the navigation device **100** is a GPS vehicle navigation device. The navigation device **100** includes an input device **102**, a storage media **104**, a database **106**, a microphone **108**, a speaker **110**, a display **112**, a memory **114**, a CPU **116**, and a GPS receiver **118** coupled together through a bus **120**.

FIG. **2** illustrates an exemplary touch sensitive character input screen **200** as displayed on the input device **102**. In one embodiment, a keyboard and mouse can be used instead of the input screen **200** to provide inputs to the navigation device **100**. The input screen **200** includes a title field **202**, an input textbox **204**, alphanumberic keys **206**, a backspace key **208**, a list key **210**, and other keys commonly found on a conventional keyboard. Not all keys **206** are necessarily enabled at a given time. As the user enters characters, keys **206** that are not likely to be used by the user may be disabled as indicated by the depicted shading for certain of the keys **206**. In one embodiment, NLT can be used for predictive character selection.

A user sequentially depresses keys on the input screen **200** to enter the name of a city that the user wishes to find with the navigation device **100**. Based on the characters or letters entered by the user, a "best" candidate for the city sought by the user is selected by the navigation device **100** and displayed in the input textbox **204**.

To minimize keystrokes by the user, and optimize the speed of correctly determining the city name sought by the user, a best candidate is selected from sequential resort to the following two lists of cities: 1. Last Used City List (LUCL) and 2. Global City List, as described in more detail below. Once selected, the best candidate is displayed in the input textbox **204** after each character entry by the user. In this manner, space on the input screen **200** is conserved while, at the same time, the best candidate is displayed in response to character entry by the user. If users do not select the best candidate presented in the input textbox **204** and continue entering characters, this candidate is disregarded in the following candidate selections and the next best candidate is displayed.

In one embodiment, characters typed by the user in the input textbox **204** may be displayed in dark color while predicted characters are displayed in light color. The contrast between dark colored characters and light colored characters distinguishes the letters in the displayed city name that have been input by the user versus the letters in the displayed city name that have not been input by the user. In another embodiment, the characters input by the user and the characters not input by the user in the displayed city name are distinguished in another manner without the use of color or shade of the characters in the input textbox **204**.

When the first character of the desired city name is typed by the user, the LUCL is checked first. The best candidate is the first match which contains the characters entered by the user as its leading substring. The LUCL contains a bound on or range of the number of city names that were last used by the user. In one embodiment, the number of last used city names in the LUCL is **20**. In another embodiment, the number of last used city names in the LUCL is a number other than **20**, depending on a particular application and other factors such as ease and speed of use. Likewise, the number of last used city names in the LUCL may even be a range of numbers.

The LUCL may contain a list of city names along with associated upper-level administrations such as the state in which the city is located. In one embodiment, the city name and associated upper-level administration of the best candidate are displayed together in the input textbox **204**. In one embodiment, the LUCL may also contain the names of municipalities, counties, states, and other geographic regions and upper level administrations by themselves. Names of cities and other regions in the LUCL are unique, and the LUCL preferably does not contain duplicate occurrences of a city or other region.

The LUCL is sorted by time with the most recently selected city name positioned at the top of the LUCL. Other previously selected city names are then listed below the most recently selected city name, with the most recent selections at the top of the LUCL and the least recent selections at the bottom of the LUCL. The most recently selected city name is preferably stored in RAM during search. In the event of multiple city name matches with the input provided by the user, the first match is the most recently match in the LUCL, and is selected as the best candidate.

As stated above, the number of city names in the LUCL preferably does not exceed a certain number, or falls within a certain range. Accordingly, previously selected city names that fall outside the certain number or range of the LUCL do not appear in the LUCL. Limiting the size of the LUCL in this manner renders the LUCL easy to maintain. By sorting and prioritizing on the basis of previous selections, the number of sorts is minimized and the time required to find the city name sought by the user is fast.

As the user sequentially enters characters on the input screen **200**, the best candidate from the LUCL is displayed in the input textbox **204**. The user may select the best candidate by touching the displayed city name in the input textbox **204**. In one embodiment, the user may select the displayed best candidate by touching another key on the input screen **200**.

When there is no matching entry in the LUCL, the Global City List (GCL) is then checked for a city match that is geographically nearest to the user's current position. In accordance with the present invention, the GCL may be associated without a spatial index or with a spatial index.

When the GCL does not have a spatial index, the GCL includes a name list sorted alphabetically and, for each city, location information with an indication of latitude and longitude only. In accordance with the GCL, the navigation device **100** performs the following process to find a best candidate.

As a user of the navigation device **100** enters characters, a binary search is run to find upper and lower boundaries of a matching subset list in the alphabetically sorted GCL. The subset list is continuous. All city names in the subset list contain the characters entered by the user as their leading substring.

The subset list is re-sorted based on the geographic distance between each city name and the current position of the navigation device **100**. Because the GCL does not have a spatial index, the calculation of geographic distances between the navigation device **100** and city names involves processing by the navigation device **100** and attendant delay. Thus, to ensure timely response, and to minimize undue delay, the subset list can be reduced to a manageable number of city names before re-sorting by adjusting the lower boundary if the number of city names exceeds a certain threshold.

In one embodiment, the threshold number of city names is approximately 200. In another embodiment, the threshold number depends on, for example, the processing speed and power of the navigation device **100** as well as other factors to optimize the speed of re-sorting the subset list for a particular

environment and user expectations. In one embodiment, to save time, a Manhattan distance calculation algorithm is used as the geographic distance between each city name and the current position of the navigation device **100**. In one embodiment, another distance calculation algorithm may be used for the geographical distance. The first city name in the re-sorted subset list, which is geographically nearest to the current position, is displayed as the best candidate.

When the number of matches in the Global City List is larger than the threshold number, users are prompted to enter more characters. The best candidate is not necessarily the geographically nearest match in the Global City List. When the number of matches is smaller than the threshold number, the user has an option to display the subset list of matches sorted by geographic distance. In this regard, a list key **210** on the input screen **200** is enabled when the number of matches is smaller than the threshold number. The enabled list key **210** may be depressed when the displayed best candidate is not desired by the user. As shown in FIG. **3**, depression of the enabled list key **210** causes display of a list screen **300** showing a list **304** of matching city names sorted by distance to the current position. The list screen **300** displays matching city names from the subset list. In one embodiment, the best candidate is highlighted in the list screen **300** and appears in the top portion of the list screen **300** where the user is more likely focused. An alphabetical order button **310** is located on the list screen **300**. If the city name desired by the user cannot be easily found on the list screen **300**, the user may depress the alphabetical order button **310**. Upon depression of the alphabetical order button **310**, all matching city names are displayed in the list screen **300** in alphabetical order. This option is also helpful for cases when the same city name exists in multiple regions.

A scroll up button **306** and a scroll down button **308** on the list screen **300** allow the user of the navigation device **100** to scroll through matching city names in the subset list and thus find the desired city name. In accordance with the present invention, only the top matching city names from the subset list needed to fill the list screen **300** are initially fetched and displayed on the list screen **300**. By fetching only a portion of all the matching city names in the subset list, the time delay required to display city names on the list screen **300** can be minimized. The time savings is especially great when the subset list of matching city names is large. Through selection of the scroll up button **206** and the scroll down button **308**, the user may scroll to matching city names in the subset list that are not initially displayed in the list screen **300**. The matching city names are additionally fetched and displayed in accordance with scrolling by the user. By displaying matching city names as they are desired by the user, the present invention avoids the inefficiencies of conventional systems that retrieve city names from a global city list all at one time.

When a GCL that is sorted alphabetically includes a spatial index, searching for the geographically nearest city names is more efficient. In accordance with the present invention, the navigation device **100** performs the following process to search for the geographically nearest city names. City names within a predetermined distance from the current position of the navigation device **100**, or search radius, are retrieved. The predetermined distance can be appropriately increased if the number of city names within the predetermined distance is small or decreased if the number of city names within the predetermined distance is large. The subset list is re-sorted based on the geographic distance between each city name and the current position of the navigation device **100** and the user. In one embodiment, to save time, Manhattan distance calculation algorithm can be used.

As characters are entered by the user, the first matching city name will have a leading substring that matches the characters entered by the user. The first matching city name in the re-sorted subset list is displayed as the best candidate.

If there is no city name in the subset list that matches the characters inputted by the user, the first matching city name in the GCL is selected as the best candidate. The best candidate is then displayed.

At the option of the user, the list key **210** can be depressed by the user to see on the list screen **300** all matching city names in the subset list within the predetermined distance sorted by geographic distance. If there is no matching city name in the subset list, all matching city names in the GCL can be displayed. Otherwise, upon depression of the alphabetical order button **310**, all matching city names are displayed in the list screen **300** in alphabetical order.

Voice recognition can also be used in accordance with the present invention. The user can provide city names using spoken words and voice commands as user input to the navigation device **100** appropriately configured to receive such words and commands. Once spoken words or voice commands are received by the navigation device **100**, a phrase matching the city name provided by the user is searched for in a recognition vocabulary and a best candidate is found. In one embodiment, the recognition vocabulary is the GCL. Because the GCL can be quite large and because some city names have the same or similar pronunciation, multiple matching city names may exceed a predefined confidence level. When two or more matching city names exceed the predefined confidence level, the LUCL and the geographic distance from the city name to the current position of the navigation device **100** can be used to filter or resort matching city names accordingly and the device can present the best candidate or a list of candidates in a sorted order.

As provided by the present invention, the selection of a desired city name is optimized because users desiring mobile navigation information often target or prefer city names that they have selected before or that are near their current position. Further, as provided by the present invention, the time required to find and select a desired city name is fast and often immediate.

FIG. **4** is a flow chart of an exemplary method **400** involving determination of a best candidate when the GCL has no spatial index. The method begins at block **402** and proceeds to block **404**. At block **404**, characters entered by the user are received by the navigation device **100**. The method **400** proceeds to decision block **406** where the navigation device **100** attempts to find a matching city name in the LUCL based on the user input. If a matching city name is found, the method **400** proceeds to block **408** where the most recently used matching city name is picked as the best candidate. The method **400** proceeds to block **410** where the best candidate is displayed. The method **400** proceeds to block **420** where the method **400** ends.

If a matching city name is not found at decision block **406**, the method **400** proceeds to block **412**. At block **412**, the number of matching city names in the GCL is checked, and the method **400** proceeds to decision block **414**. At decision block **414**, if the number of matching city names exceeds a threshold number (for example, 200), the method **400** proceeds to block **416**. At block **416**, the subset list is reduced to the first matching city names within the threshold number (for example, **200**), and the method **400** proceeds to block **418**. At block **418**, the geographically nearest matching city name is picked as the best candidate, and the method **400** proceeds to block **410**. At block decision **414**, if the number of matching

city names does not exceed a threshold number (for example, **200**), the method **400** proceeds to block **418**.

FIG. **5** is a flow chart of an exemplary method **500** involving the listing of matching city names by geographic distance when the GCL has no spatial index. The method **500** begins at block **502** and proceeds to block **504**. At block **504**, characters entered by the user are received by the navigation device **100**. The method **500** proceeds to block **506** where the number of matching city names in the GCL is checked. The method proceeds to decision block **508** where it is determined whether the number of matching city names exceeds a certain threshold (e.g., **200**). If so, the method **500** proceeds to block **504** where more characters are entered by the user. If not, the method **500** proceeds to block **510** where the list key **210** is enabled.

The method **500** proceeds to block **512** where an indication that the list key **210** has been depressed is received. The method **500** proceeds to block **514** where the matching city names are sorted in geographic distance in ascending order and displayed in the list screen **300**. The method **500** proceeds to block **516** where an indication that the alphabetical order button **310** has been depressed is received. The method **500** proceeds to block **518** where matching city names are displayed in alphabetical order. The method **500** proceeds to end at block **520**.

FIG. **6** is a flow chart of an exemplary method **600** involving determination of a best candidate when the GCL has a spatial index. The method **600** begins at block **602** and proceeds to block **604** where characters input by the user are received by the navigation device **100**. The method proceeds to decision block **606** where it is determined if matching city names are found in the LUCL. If so, the method **600** proceeds to block **608** where the most recently used matching city name is picked as the best candidate. The method **600** proceeds to block **610** where the best candidate is displayed and the method proceeds to block **624** where the method **600** ends.

At decision block **606**, if matching city names are not found in the LUCL, the method **600** proceeds to block **612** where matching city names within a certain geographic distance (e.g., **20** miles) are searched for. The method **600** proceeds to decision block **614** where it is determined if any matching city names are found. If so, the method **600** proceeds to block **622** where the geographically nearest city is picked as the best candidate, and the method **600** proceeds to block **610**. If not, the method **600** proceeds to block **616** where matching city names within another certain geographic distance (e.g., **50** miles) are searched for. The method **600** proceeds to decision block **618** where it is determined if any matching city names are found. If so, the method **600** proceeds to block **622**. If not, the method **600** proceeds to block **620** where the first matching city name in the GCL is picked as the best candidate. The method **600** proceeds to block **610**.

In one embodiment, the input device **102** of the navigation device **100** includes the touch sensitive character input screen **200** to receive user inputs. In one embodiment, a keyboard and a mouse are used instead of the input screen **200**. The navigation device **100** includes the storage media **104**, the database **106**, and the memory **114**, each of which may be constitute a machine-readable medium on which one or more sets of instructions (e.g., software) are stored. The one or more sets of instructions embody any one or more of the methodologies or functions described herein. The software may also reside, completely or at least partially, within the CPU **116** during execution thereof by the CPU **116** and the navigation device **100**. The software may further be transmitted or received over a network.

The term "machine-readable medium" should be taken to include a single medium or multiple media (e.g., a centralized or distributed database, and/or associated caches and memory) that store the one or more sets of instructions. The term "machine-readable medium" shall also be taken to include any medium that is capable of storing, encoding or carrying a set of instructions for execution by the machine and that cause the machine to perform any one or more of the methodologies of the present invention. The term "machine-readable medium" shall accordingly be taken to include, but not be limited to, solid-state memories, optical, and magnetic media.

In general, the routines executed to implement the embodiments of the disclosure, may be implemented as part of an operating system or a specific application, component, program, object, module or sequence of instructions referred to as "programs." For example, one or more programs may be used to execute specific processes described herein. The programs typically comprise one or more instructions set at various times in various memory and storage devices in the machine, and that, when read and executed by one or more processors, cause the machine to perform operations to execute elements involving the various aspects of the disclosure.

Moreover, while embodiments have been described in the context of fully machines, those skilled in the art will appreciate that the various embodiments are capable of being distributed as a program product in a variety of forms, and that the disclosure applies equally regardless of the particular type of machine or computer-readable media used to actually effect the distribution. Examples of machine-readable media include but are not limited to recordable type media such as volatile and non-volatile memory devices, floppy and other removable disks, hard disk drives, optical disks (e.g., Compact Disk Read-Only Memory (CD ROMS), Digital Versatile Disks, (DVDs), etc.), among others, and transmission type media such as digital and analog communication links.

Although embodiments have been described with reference to specific exemplary embodiments, it will be evident that the various modification and changes can be made to these embodiments. Accordingly, the specification and drawings are to be regarded in an illustrative sense rather than in a restrictive sense. The foregoing specification provides a description with reference to specific exemplary embodiments. It will be evident that various modifications may be made thereto without departing from the broader spirit and scope as set forth in the following claims. The specification and drawings are, accordingly, to be regarded in an illustrative sense rather than a restrictive sense.

What is claimed is:

1. A computer implemented method comprising:

receiving, with a navigation device, user input regarding a desired city name;

determining whether the user input matches a city name in a Last Used City List;

when determined that the user input matches the city name in the Last Used City List, selecting the city name in the Last Used City List that matches the user input as a best candidate;

when determined that the user input does not match any city name in the Last Used City List, consulting a Global City List, wherein consulting the Global City List includes:

determining whether a number of city names in the Global City List matching the user input exceeds a predetermined threshold; and

selecting a city name in the Global City List matching the user input that is geographically nearest to the navigation device as a best candidate when the number of city names in the Global City List matching the user input does not exceed the predetermined threshold; and

displaying the best candidate in response to character entry by the user.

2. The method of claim **1**, further comprising selecting the matching city name most recently used as the best candidate from the Last Used City List sorted by time.

3. The method of claim **1**, wherein the consulting the Global City List further comprises having the GCL in alphabetical order.

4. The method of claim **1**, wherein the consulting the Global City List further comprises reducing the number of matching city names to a predetermined threshold by picking first predetermined number of matches and disregarding the remainder when the number of matching city names exceeds the predetermined threshold.

5. The method of claim **1**, further comprising:

enabling a list key of the navigation device when the number of matching city names in the Global City List does not exceed a predetermined threshold;

receiving an indication of selection of the list key; and

listing the matching city names.

6. The method of claim **5**, further comprising sorting the matching city names by geographic distance.

7. The method of claim **6**, further comprising:

receiving an indication to display the matching city names in alphabetical order; and

displaying the matching city names in alphabetical order.

8. The method of claim **5**, further comprising:

checking the number of matching city names in the Global City List; and

receiving further user input regarding the desired city name until the number of matching city names does not exceed the predetermined threshold before the enabling, the receiving, and the listing.

9. The method of claim **1**, wherein the consulting a Global City List with spatial index comprises:

selecting cities which are within a first predetermined geographic distance from the navigation device;

determining whether city names match a substring entered by a user; and

selecting the matching city name that is geographically nearest to the navigation device as the best candidate when the matching city names are within the first predetermined geographic distance from the navigation device.

10. The method of claim **9**, wherein the consulting a Global City List with spatial index further comprises determining whether the matching city names are within a second predetermined geographic distance from the navigation device when no matching city names are found within the first predetermined geographic distance.

11. The method of claim **10**, wherein consulting the Global City List with spatial index further comprises selecting a first of the matching city names in the Global City List as the first best candidate when none of the matching city names are within the second predetermined geographic distance.

12. The method of claim **10**, wherein consulting the Global City List with spatial index further comprises selecting the matching city name that is geographically nearest to the navigation device as the first best candidate when the matching city names are within the second predetermined geographic distance.

13. The method of claim **10**, wherein the second predetermined geographic distance is greater than the first predetermined geographic distance.

14. The method of claim **1**, wherein the user input includes voice commands.

15. The method of claim **1**, further comprising disregarding the best candidate presented previously and displaying a next best candidate, if a user does not select the previously presented best candidate and continues entering characters.

16. A non-transitory machine-readable medium that provides instructions for a processor, which when executed by the processor cause the processor to perform a method comprising:

receiving, with a navigation device, user input regarding a desired city name;

determining whether the user input matches a city name in a Last Used City List;

when determined that the user input matches the city name in the Last Used City List, selecting the city name in the Last Used City List that matches the user input as a best candidate;

when determined that the user input does not match any city name in the Last Used City List, consulting a Global City List, wherein consulting the Global City List includes:

determining whether a number of city names in the Global City List matching the user input exceeds a predetermined threshold; and

selecting a city name in the Global City List matching the user input that is geographically nearest to the navigation device as a best candidate when the number of city names in the Global City List matching the user input does not exceed the predetermined threshold; and

displaying the best candidate in response to character entry by the user.

17. The machine-readable medium of claim **16**, wherein the consulting the Global City List (GCL) further comprises:

determining whether the number of matching city names exceeds a predetermined threshold; and

selecting the matching city name that is geographically nearest to the navigation device when the number of matching city names does not exceed the predetermined threshold.

18. A system comprising:

means for receiving user input regarding a desired city name;

means for determining whether the user input matches city names in a Last Used City List;

means for, when determined that the user input matches the city name in the Last Used City List, selecting the city name in the Last Used City List that matches the user input as a best candidate;

means for, when determined that the user input does not match any city name in the Last Used City List, consulting a Global City List, wherein consulting the Global City List includes:

determining whether a number of city names in the Global City List matching the user input exceeds a predetermined threshold; and

selecting a city name in the Global City List matching the user input that is geographically nearest to the navigation device as a best candidate when the number of city names in the Global City List matching the user input does not exceed the predetermined threshold; and

means for displaying the best candidate in response to character entry by the user.

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