DECLARATION OF ACCURACY

I, David Baldwin, declare the following:

1. I am over 18 years of age and competent to make this declaration.

2. I am a qualified Japanese to English translator.

3. I have translated the attached document identified as JPH08-285613.

4. I affirm that the translated text has been translated and edited to the best of my ability and knowledge to accurately reflect the content, meaning, and style of the original text and constitutes in every respect a correct and true translation of the original document.

5. I declare that all statements made herein of my knowledge are true, and that all statements made on information and belief are believed to be true, and that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

I hereby certify under penalty of perjury under the laws of the United States of America that the foregoing is true and correct. Dated and signed on August 8, 2019.

(Translator's Signature)

David Baldwin

(Translator's Printed Name)

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(71) Applicant 000004226
Nippon Telegraph and Telephone Corporation, 3-19-2 Nishishinjuku, Shinjuku-ku, Tokyo-to

(72) Inventor Kazunori Akiyama
c/o Nippon Telegraph and Telephone Corporation, 1-1-6 Uchisaiwai-cho, Chiyoda-ku, Tokyo-to

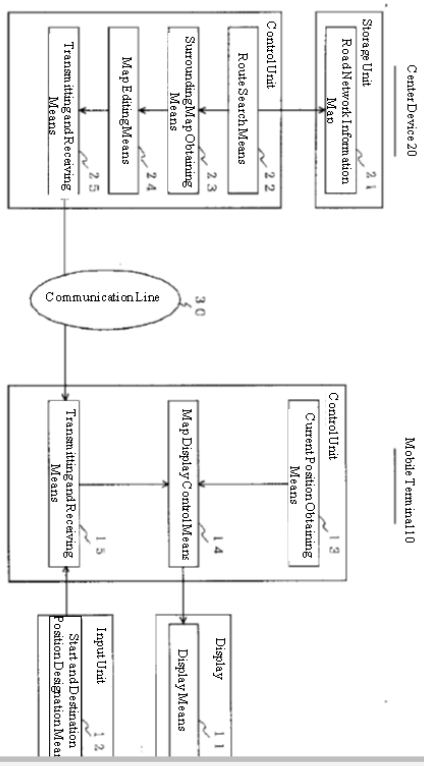
(72) Inventor Tsuneo Yasuda
c/o Nippon Telegraph and Telephone Corporation, 1-1-6 Uchisaiwai-cho, Chiyoda-ku, Tokyo-to

(72) Inventor Kaoru Wakabayashi
c/o Nippon Telegraph and Telephone Corporation, 1-1-6 Uchisaiwai-cho, Chiyoda-ku, Tokyo-to

(74) Agent Makoto Suzuki, Patent Attorney

(54) [Title of Invention] CENTRALIZED INFORMATION MANAGEMENT NAVIGATION SYSTEM

(57) [Abstract]
[Purpose] To use information at the level of a detailed residential map to provide extremely in-depth route guidance in real time and relieve the user of the burdens of saving and managing map data.
[Constitution] A navigation system is configured by a mobile terminal 10 carried by a user and a center device 20 connected to the mobile terminal via a communication line 30, and a detailed road network information map 21 at the level of a residential map is centrally managed in a storage unit of the center device 20. The mobile terminal side designates a start position and destination position using 12, and sends respective coordinate data to the center device side via 15. In the center side, 22 accesses 21 to obtain a route based on the received coordinate data, 23 obtains surrounding map data along the route from 21, 24 edits this surrounding map data, and it is then sent to the terminal side via 25. The terminal side then displays the received map data focusing on the current position acquired by 13.



Functional Block Diagram of the System of the Present Invention

[Scope of Patent Claims]

[Claim 1] A centralized information management navigation system configured by a mobile terminal carried by a user and a center device connected to the mobile terminal via a communication line, wherein:

the mobile terminal comprises: current position obtaining means for obtaining a current position; input means for designating a start position and destination position; display means for displaying map data; map display control means for controlling display of map data on the display means; and sending and receiving means for communicating with the center device;

the center device comprises: storage means for storing a detailed road network information map at the level of a residential map; route search means for obtaining a route to a destination; surrounding map obtaining means for obtaining surrounding map data of a route from the road network information map; and sending and receiving means for communicating with the terminal side;

in the mobile terminal, the input means designates a start position and destination position, and the sending and receiving means transmits coordinate data of the start position and destination position to the center device;

in the center device, the route search means obtains a route by accessing the road network information map based on the coordinate data of the start position and destination position from the mobile terminal, the surrounding map obtaining means obtains surrounding map data along the obtained route from the road network information map, and the sending and receiving means transmits the surrounding map data to the mobile terminal; and

in the mobile terminal, the sending and receiving means receives the surrounding map data from the center device, the map display control means displays the current position obtained by the current position obtaining means or the surrounding map data focusing on a destination position on the display means, and gives guidance for a route by relatively moving a map display along with movement of the mobile terminal.

[Claim 2] The centralized information management navigation system according to claim 1, wherein the center device comprises: map editing means for editing characters and building figures in the surrounding map data along the route obtained by the surrounding map obtaining means in a manner that is easy to view on the display means on the mobile terminal side.

[Detailed Description of the Invention]

[0001]

[Industrial Field of Application] The present invention relates to an on-vehicle and mobile navigation device (navigation system), and more particularly relates to a centralized information management navigation system.

[0002]

[Conventional Art] In recent years, development of so-called car navigation systems for giving course guidance to a driver in accordance with a course that has been set before driving has become prevalent.

[0003] Conventionally, such car navigation systems and navigation systems that can be carried by people are generally realized using one component (there are products

wherein the display and the control unit are separate products, but these are seen as one component because they are installed together in the same location), and data management and the like is performed by a road network information map being stored on a storage medium such as a CD-ROM, memory card, and the like and directly stored in the navigation system. Furthermore, in conventional navigation systems, a road map of 25,000 to 1 or less detailed is generally used, and it is normal to only have road information of a specific reference (prefecture roads or the like).

[0004]

[Problem to be Solved by the Invention] The conventional navigation system above has the following problems. (1) When attempting to use a road network information map (for example, a scale of 1/2,500 or the like) at the level of a detailed residential map as map data, the amount of data is extremely large when compared to a road network information map (for example, a scale of 1/2,500 or the like) at the level of a road map, and a larger memory is required, which makes it extremely difficult to handle on each navigation system.

[0005] (2) Therefore, a less detailed road map (25,000 to 1 or even less detailed road map) is used in conventional navigation systems, but only general road guidance can be realized in this case. FIG. 8 illustrates this. Furthermore, FIG. 9 illustrates that because only the portion of the thick line has road network information on the road map, when attempting to realize route guidance using this, guidance is not possible between the information point of the nearest road network (2) from a current position (1) and between the information point of the nearest road network (3) from a destination (4).

[0006] (3) Because road network information in the conventional navigation system only has road information of a specific reference (prefecture road and the like) or higher as described above, it is impossible to obtain the shortest route using a residential road or the like even if there is one, and it is impossible to give guidance. FIG. 10 illustrates this. This is particularly unsuitable for navigation systems for pedestrians.

[0007] (4) In the conventional navigation system, map data stored in a storage medium is bought, saved, and managed by a user, but it becomes necessary to repurchase if there is a new version of the map or the like, which requires a large amount of money. Additionally, such versions are only released once every several years and thus updates to the map which occur daily cannot be immediately reflected to the navigation system user.

[0008] (5) Even when using a road network information map at the level of a residential map, when attempting to display such data in a manner that is easy to view on the display of the navigation system, it is only possible to display a narrow area because the display is small, which makes it even harder to understand because positional relationships become unclear. Furthermore, even if the scale is increased in an attempt to display even a slightly wider range on the display, the figures of the houses, roads, characters, and symbols are small and compressed, which makes it even more difficult to see.

[0009] (6) Because a road network information map at the level of a residential map has a large amount of information, a user owns a large number of storage media because the region that can be stored in one storage medium (CD-ROM or memory card) is small. Furthermore, the number of storage media to replace during use also increases, which is inconvenient for the user.

[0010] In light of the above, an object of the present invention is to use information at the level of a detailed residential map which takes in daily updates on a map to make it possible to edit and provide extremely in-depth route guidance in real time in a manner that is easy to view on a relatively small display, and to provide a centralized information management navigation system that can relieve the user of the burdens of saving and managing the map data and the like.

[0011]

[Means for Solving the Problem] As illustrated in FIG. 1, the centralized information management navigation system in the present invention is configured by a mobile terminal 10 carried by a user and a center device 20 connected to the mobile terminal via a communication line 30, wherein: the mobile terminal 10 is provided with: display means 11 for displaying map data; start and destination position designation means 12 for designating a start position and destination position; current position obtaining means 13 for obtaining a current position; map display control means 14 for performing control for displaying map data on the display means 11; and sending and receiving means 15 for communicating with the center device 20, and the center device 20 comprises: a detailed road network information map (for example, a scale of 1/2,500) 21 at the level of a residential map; route search means 22 for searching for and obtaining a route to a destination by accessing the road network information map 21; surrounding map obtaining means 23 for obtaining a minimum amount of surrounding map data required for displaying on the display of the mobile terminal along the obtained route from the road network information map 21; map editing means 24 for performing a thinning of characters or thinning of building figures and the like to be able to display on the display of the terminal side in a manner that is easy to view; and sending and receiving means 25 for communicating with the mobile terminal 10.

[0012] First, in the mobile terminal 10, the start and destination position designation means 12 designates a start position and a destination position, and respectively acquired coordinate data is transmitted to the center device 20 using the sending and receiving means 15. In the center device 20, the sending and receiving means 25 receives coordinate data of the start position and destination position from the mobile terminal 10, and the route search means obtains a route by accessing the road network map information 21 based on this data. The surrounding map obtaining means 23 obtains a minimum amount of surrounding map data (figures, characters, symbols, and the like) required for displaying on the display of the mobile terminal 10 along this route from the road network information map 21, the map editing means 24 edits the characters or building figures in the obtained map information, and the sending and receiving means 25

transmits the edit results data to the mobile terminal side. In the mobile terminal 10, the sending and receiving means 15 receives surrounding map data from the center device 20, and the map display control means 14 displays the current position obtained by the current position obtaining means 13 or the surrounding map data focusing on the destination position on the display means 11.

[0013]

[Action] In the centralized information management navigation system of the present invention, the navigation system configuration is separated into a mobile terminal carried by a user and a center device connected to the mobile terminal via communication lines, and by transmitting a minimum amount of required map information to the mobile terminal from the center device, guidance is given for a route by relatively moving a map display along with the movement of the mobile terminal.

[0014] This makes it possible to realize road network information at the level of a residential map in the limited memory of the mobile terminal, which is difficult to handle in the conventional navigation system, and obstacles such as figures or characters becoming compressed and difficult to see can be prevented because map editing is performed in the processing of the center device so that the map information is easy to view on the display of the mobile terminal.

[0015] Furthermore, because a minimum amount of surrounding map data (figures, characters, and symbols) required for being displayed on the display of the mobile terminal along a set route are obtained from the road network information map on the center side in the processing in the center device, it is possible to realize a reduction of communication between the center device and the mobile terminal and a reduction of processing data on the center device and the mobile terminal.

[0016] Additionally, the user is relieved from the burdens of managing and saving on the map storage medium because a road network information map at the level of a residential map is centrally managed and operated. Furthermore, modifications to the map that occur daily can be made simply by updating the road network information map centrally managed in the center device, and updated content can be instantly reflected to the user of the navigation system. Moreover, the user is not required to have a map storage medium at hand, and convenience is improved because a plurality of CD-ROMs separated by each region does not need to be switched while moving or the like.

[0017]

[Embodiments] One embodiment of the present invention will be described below with reference to drawings.

[0018] FIG. 2 is a block diagram illustrating one embodiment of the center device of a system for carrying out the centralized information management navigation system according to the present invention. In FIG. 2, 200 is a CPU such as a microprocessor managing the control of the entire center device, 210 is an external storage unit such as a hard disk for storing a road network information map 215 (corresponding to 21 in FIG. 1) at the level of a residential map, 220 is a route search unit (corresponding to 22 in FIG. 1) for accessing the road network information

map 215 and obtaining a route to a destination, 230 is a surrounding map obtaining unit (corresponding to 23 in FIG. 1) for obtaining a minimum amount of surrounding map data (figures, characters, and symbols) required for being displayed on the display of a mobile terminal along this route from the road network information map 215, 240 is a map editing unit (corresponding to 24 in FIG. 1) for performing a thinning of characters or thinning of building figures from the surrounding map data so that the map can be displayed on the display of the mobile terminal in a manner that is easy to view, and 250 is a sending and receiving unit (corresponding to 25 in FIG. 1) for performing the control and the like of a communication line 30 for sending and receiving data with the mobile terminal. Note that the CPU 200 may also have the processing functions of the route search unit 220, surrounding map obtaining unit 230, and map editing unit 240.

[0019] Here, the connection relationship of the roads is indicated by, for example, a graph structure in the road network information map 215 stored in the external storage unit 210, and data is used having various attributes relating to roads added thereto. The nodes of this graph structure indicate intersections, and the edges indicate roads. The roads have coordinate lists indicating name, level (indicating national highway, express way, and the like), length, width, and shape roads as the attribute values thereof, and the intersections have a name and coordinates as the attribute values thereof. These attributes are attributes that are required considering route searching and the like. Note that the curve points of roads and endpoints of roads that curve in an L-shape are considered intersections for convenience in addition to cross-shaped and T-shaped roads.

[0020] Road network information in a graph structure is not only appropriate for expressing roads, but also has advantages such as being able to use knowledge of graph theory, and can therefore be considered to be data that forms the basis of all applications relating to maps (reference literature: Tanaka et. al "Extraction of Road Network via Road Tracking Algorithm," Information Processing Society of Japan 45th National Convention, 1J-1 (1992); and Horie et. al "Generation of Road Network from Vector Map" Shingakukai Spring Convention D-466 (1994)).

[0021] FIG. 3 is a block diagram illustrating one embodiment of the mobile device of the centralized information management navigation system according to the present invention. In FIG. 3, 300 is a CPU such as a microprocessor managing the control of the entire terminal, 310 is a screen display device (corresponding to 11 in FIG. 1) for displaying map data, and 220 is an input device (corresponding to 12 in FIG. 1) for designating a start position and a destination position. 330 is a current position obtaining unit (corresponding to 130 in FIG. 1) for obtaining current position coordinates of the mobile terminal, and is made up of a GPS 332 for obtaining current position coordinates of the mobile terminal, a travel distance sensor 334, a magnetic field sensor 336, and a sensor interface unit 338 for converting these sensor signals into signals that can be processed in the CPU 300. 340 is a map display control unit (corresponding to 14 in FIG. 1) for

performing control for displaying a map on a screen display device 310, and is made up of a map control unit that relatively moves a map display along with the movement of the mobile terminal focusing on the current position or destination position and displays an arrow or the like in the direction of travel, a graphic controller 344 for displaying map data on the screen display device 310 while being controlled by the map control unit 342, and a graphic memory 346 for storing map data. 350 is a sending and receiving unit (corresponding to 15 in FIG. 1) for performing the control and the like of a communication line for sending and receiving data with the center device. Note that the CPU 300 may also have a portion or all the functions of the map display control unit 340.

[0022] FIG. 4 shows a flowchart of the mobile terminal side, and FIG. 5 shows a flowchart of the center device side. The operation of the embodiments in FIG. 2 and FIG. 3 will be described with reference to the flowcharts in FIG. 4 and FIG. 5.

[0023] First, when processing begins, the user designates and inputs a start position and a destination position using the input device 320 on the mobile terminal side (step S1). The input device 320 may be a joystick, and the position may be designated using an address or the like. When a start position and destination position are obtained, the mobile terminal is connected to the center device via a communication line 30 using the sending and receiving unit 350, and start position coordinate and destination position coordinate data is transmitted to the center device (step S2). Next, the flow transitions to the processing on the center side.

[0024] Processing begins in the center device, which is always standing by, when there is a call from the mobile terminal side. The center device receives start position coordinate and destination position coordinate data from the mobile terminal using the sending and receiving unit 250 (step S10), the route search unit 220 accesses the road network information map 215 in the external storage unit 210 based on this coordinate information and searches and obtains a route from the start position to the destination position (step S11), and map data (characters, building figures, symbols, backgrounds or the like) in a range of X (m) on both sides of the obtained route is extracted from the road network information map 215 in the surrounding map obtaining unit 230 (step S12). Here, X is any predetermined value, and prescribes the minimum range of data required to fit onto the display on the mobile terminal side.

[0025] FIG. 6 is a diagram describing the relationship of this route and the extracted map data, wherein 610 is the route, 620, which is surrounded by a broken line, is the map data (surrounding map data) extracted from the road network information map 215, and 630 is the size (display range) of the display.

[0026] Next, the map editing unit 240 executes steps S13 to S16 in the center device. First, a check is performed as to whether there is any overlapping of data when the extracted map data is displayed on the display of the mobile terminal side (step S11). If there is any overlap, one piece of the overlapping data is left and the other is removed (step S14). In such a case, a priority order (leaving symbols as much as

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