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(54) **Information display system for vehicle navigation**

(57) In order to provide a navigation system intelligibly providing various information which contains information to vary with time and is expected by the user, without increasing quantity of the information to be transmitted to a terminal mounted on a car, a navigation system is constituted with an information offering equipment and an information display system, and said information offering equipment has an individual information reception means (80) to obtain individual information through a network and a data transmission means to transmit the received information to the information display system, and said information display system has a data receiver receiving the data from the information offering equipment, a map display means (54), an icon display means (64) displaying the received data on a map, an icon select means (67), and a detailed information display means which displays the detailed information of an icon selected.

FIG.6
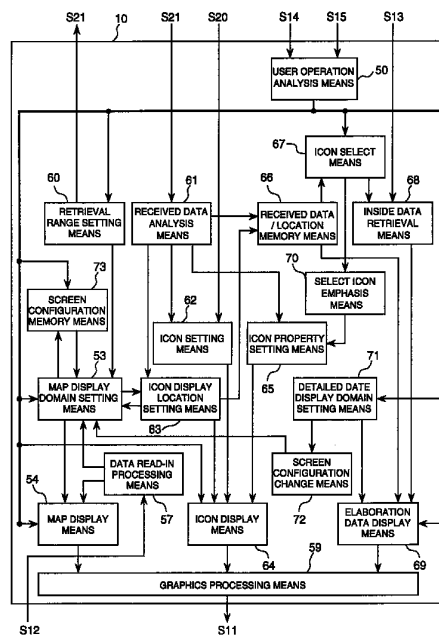
Description

BACKGROUND OF THE INVENTION

The present invention relates to an information display system, especially relates to a navigation system providing a course guidance to a predetermined place by calculating a car's position and displaying the car's position with a map therearound on a display, said navigation system providing information for a user intelligibly by obtaining said information from a network like the internet from which various kinds of data are provided.

Navigation system shows a car's calculated position based on various sensor information on a display, with a map surrounding the car's position, by taking out map data stored in a CD-ROM, and by setting a goal position, and a course guidance to the goal position is shown on the display.

In the CD-ROM, various information necessary for a driving car, such as information about sightseeing spot or information of gas service station are inputted and indicated on the display according to a request of the user.

In this case, necessary information should be stored beforehand in the CD-ROM. As the CD-ROM is used only to be read out, it is not suitable for use as a medium to store information changing with time, for example, a traffic jam information. Even if it is assumed that a rewritable memory is used temporarily, it is troublesome for the user to input the information.

In order to solve such problem in the conventional navigation system, as shown by Japanese Patent Laid-open Nos. 7-105492(1995), 7-261661(1995), 8-139193(1996), any communication equipment is provided in the car as a navigation equipment, and receives any facility data, so as to provide the information which is not provided by CD-ROM.

In order to communicate with a car, a means of mobile communication like a cellular telephone system needs to be used. However, data transmission speed of the cellular telephone system is slow, and further, when it is used by a running car, the channel of the cellular telephone system is easy to run out, and it is not suitable for sending a large quantity of data. Furthermore, when a driver of the car wants to see the information during driving, the driver is averted from his driving depending on the information display method, and it is dangerous for the driver. The information sent by a communication means should be capable to be accessed for convenience of the user, and a good acquisition method of the information is needed.

SUMMARY OF THE INVENTION

Referring to the above stated problem, an object of the present invention is to provide a navigation system, by which much information is capable to be accessed so as to suitably control the amount of the information to be communicated and the received information is capable to be displayed intelligibly.

An navigation system is constituted with an information display equipment indicating information received through a mobile communication system, information offering equipment which obtains the information by connecting to a network and transmits the obtained information to the information display equipment, and a communication equipment.

The information offering equipment comprises a connecting means to be connected to the network and a memory means to store the information sent to the information display equipment, and obtains the information from information offering servers connected to a network and stores it in the memory means.

The information offering equipment comprises a retrieval means to retrieve the information to be provided to the user from the memory means furthermore, and a communication means to transmit and receive data with the information display equipment, thereby a kind of information demanded by the user from the information display equipment is received and the information retrieved from the memory means is transmitted to the information display equipment. In order to suitably control the amount of the data to be transmitted with the communications equipment, a data selection means and a data processing means are prepared at need.

The information display equipment comprises an input means to input a kind of the information that the user needs, and a communications means to transmit a retrieval key word input to the information offering equipment, or to receive the information provided from the information offering equipment. The information display equipment further comprises a map memory means to store map data, a map display means to retrieve the map data from the map memory means and to display the map on the display, and an icon display means to display an icon to a position where the information provided from the information offering equipment is stored, on the map displayed by the map display means. The information display equipment further comprises an icon select means by which a user selects the icon displayed on the display equipment, a retrieval means to retrieve the information about the selected icon from the information stored in a detailed information store means storing the information or the detailed information sent from the information offering equipment, and a detailed information display means to display the information retrieved to with the map on which an icon is displayed.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a constructive view of the navigation equipment to realize the present invention.

Figure 2 shows a constructive view of the information display equipment to realize the present invention.

Figure 3 shows a constructive view of the information display equipment to realize the present invention.

Figure 4 shows a view of hardware construction of the arithmetic processing department to realize the information display equipment.

Figure 5 shows a functional construction figure of the arithmetic processing department to realize the information display equipment.

Figure 6 shows a function construction figure of the arithmetic processing department to realize the information display equipment.

Figure 7 shows a function construction figure of the arithmetic processing department to realize the information offering equipment.

Figure 8 shows a view which shows the retrieve screen.

Figure 9 shows a view which retrieves by using a phone number.

Figure 10 shows a view which sets an item retrieved with precedence.

Figure 11 shows a view which displays a retrieval range.

Figure 12 shows a view which shows the range retrieved with an acquisition time.

Figure 13 shows a view which shows a retrieval range when retrieving along with a path.

Figure 14 shows a view which shows an example of a fixed form format.

Figure 15 shows a view which shows an example of a free format.

Figure 16 shows a view which displays an icon contained by the information.

Figure 17 shows a view which shows an operation in which icons do not overlap.

Figure 18 shows a view which shows location of the information with an icon on the map top.

Figure 19 shows a view which shows the individual information by changing property of the icon.

Figure 20 shows a view which displays detailed information of an icon selected.

Figure 21 shows a view which displays detailed information of an icon selected with the map.

Figure 22 shows a view which shows that detailed information are divided to be displayed into several pages.

Figure 23 shows a view which shows to come back to a former screen after offering the information.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The information provided to the user is sent from an information offering server through a network to information offering equipment, and the information that has been sent is stored in a memory equipment so as to be provided according to request of the user. When the user requests to be offered the information, the information is retrieved from this memory equipment by a retrieval condition of the user, and is transmitted to the information display equipment.

In the information offering equipment, data which should be transmitted to the information display equipment are selected and processed furthermore. The information requested by the user and transmitted to the information display equipment from the information offering equipment is displayed with an icon to the position on the map where the information is stored. When one of the icon displayed by operation of the user is selected, the detailed information which relates to the icon is displayed.

Referring to following figures, one embodiment of a navigation system having information offering equipment in this invention will be explained.

A navigation system in this embodiment as shown in Fig. 1 has information offering equipment 2 to obtain various information from an information offering server 3 connected through a network 4 such as the internet, and to provide it to a user, and an information display equipment 1 to display a car's position, to provide course guidance to the car, and to provide a presentation of the information from the information offering equipment 2 etc. according to the request of the user.

The information display equipment 1 will be explained using Fig. 2.

The information display equipment 1 has an arithmetic processing department 10, a display unit 11, a map memory 12, an internal information memory 13, a voice input and output unit 14, an input unit 15, a wheel speed sensor 16, a magnetic compass 17, a rate gyro 18, a GPS receiver 19, an icon image memory 20 and a display side communication equipment 21.

The arithmetic processing department 10 has a means to calculate a current position of a moving body like the car in which the navigation equipment is installed by using the information output from the above sensor 16,17,18 and the GPS receiver 19, and a means to select a most suitable road which connects current position with a goal position directed by the user and to notify them by using a sound and graphic display to the user.

The arithmetic processing department 10 sets a display domain according to the calculated current position of the moving body or scroll operation by the user, reads out the map data corresponding to the display domain from the map memory 12, provides graphic information from the map data which are read out, and performs a graphical processing so as to display it on the display unit 11. When the current position is displayed, the current position of the moving body is displayed by a mark with a graphics information corresponding to the map showing the neighborhood of the current position.

The display unit 11 is a unit to display the graphics information formed by the arithmetic processing department 10, and is constructed with a cathode ray tube or a liquid crystal display. The arithmetic processing department 10 is connected to the display unit with a signaling S11 such as Red Green Blue signaling or

NTSC signaling. The map memory 12 reads out / writes in necessary data from a storage media such as a CD-ROM or an integrated circuit card by receiving outside indication.

The voice input and output unit 14 converts a message to be transmitted to the user, into a voice signal, and recognizes a voice generated by the user so as to transmit it to the arithmetic processing department.

The input unit 15 is a unit to accept indication from the user, and it is constructed with, for example, a joy stick to allow scrolling the map indicated, an electric switch such as a button, a touch panel put on the display unit etc.

The wheel speed sensor 16 measures the moving distance of the moving body from a product of the circumference of a wheel of the moving body and revolution speed of the wheel, and measures the turning angle of the moving body from difference of revolution speeds between a pair of wheels. The magnetic compass 17 detects a geomagnetic field, and measures a direction where the moving body faces. The gyro 18 has an optical fiber gyro or a vibration gyro, and measures the turning angle of the moving body when the moving body turns.

The GPS receiver 19 receives a signaling from GPS satellites and calculates a current position, a moving angle and a moving direction of the moving body by measuring distance and between the moving body and satellite and a change rate of the distance relating to three or more satellites. These sensors and equipment as above are used in order to detect the current position of moving body by a navigation processing.

The icon image memory 20 stores images of icons which is used when the information got from the information offering equipment 2 is displayed on the map.

Said internal information memory 13 memorizes various kinds of information to offer to the user, and most of the information is static information which are updated with a low frequency, for example, information of a sightseeing spot, information of a gas station, guide information of the accommodations or leisure facility, and tariff information of a toll road . Here, the navigation system in the present invention has a function to offer the information depended on a map fundamentally in addition to above and there is location on a map equivalent a lot of said information to be offered. In other words, most of them are individual information that have location information which respectively correspond with the locations on the map, and the individual information is offered by appointing the location on the map, and the location of selected individual information are indicated on the map top as explained in the following.

The display side communication device 21 communicates with the information offering device 2, and obtains the information from the information offering device 2, which mainly changes with time and are updated with a high frequency, for example, traffic jam information of a road, vacant information of a hotel and a parking lot, weather information, and sale information of a store, as explained in the following. The information provided in this way from the information offering device 2 are individual information having the location information respectively corresponding to locations on the map in the same way as the individual information memorized in the internal information memory 13. The communication volume which is most suitable for the mobile communication that is one of the most distinctive characteristics of the present invention is determined by controlling not to send the information which are able to be stored by the internal information memory 13 and are not updated frequently. As it is possible to select the individual information which is related to the individual information sent by the information offering device 2, according to the location on the map, from the individual information memorized in the internal information memory 13, the sufficient information is offered while communication channel capacity is low, by combining the individual information to be related according to the necessity.

In this embodiment of the present invention, the memory is sorted into the map memory, the internal information memory, and the icon image memory according to the kind of the information to be stored, however, it is possible to store plural kinds of the information with one memory.

In addition to above, in this embodiment of the present invention, the memory consists of the map memory, the internal information memory, and the icon image memory according to a kind of the information to be stored, however one of the memories may store several kinds of the information.

For example, as shown in figure 4 as a hardware construction, the arithmetic processing department 10 is comprised of a central processing unit 31 to control the calculation and each device, a random access memory 32 to store the map data and calculation data temporarily, a read only memory 33 to store the system program, a DMA 34 to execute each data transfer between one memory and other memory at high speed and between the memory and each device, a display controller 35 to execute and indicate graphics information generation as to develop vector data in an image at high speed, a VRAM 36 to save graphics image data, a color pallet 37 to convert the image data into Red Green Blue codes, an analog-to-digital converter 38 to convert an analog signal into a digital signal, a SCI 39 to convert a serial signal into a parallel signal, a programmable input-output chip 40 to synchronize with the parallel signal and so as to output on the bus 30, a counter 41 to count pulse signal, and said bus 30 to connect between every devices.

Construction of the arithmetic processing department 10 will be explained using figure 5, and figure 6.

As shown in figure 5, the arithmetic processing department 10 is comprised of a user operation analysis means 50, a path account means 51, a course guid-

ance means 52, a present position arithmetic means 55, a map match processing means 56, and a menu display means 58, as a means mainly relating to a navigation processing such as car's position calculation and course guidance.

The present position arithmetic means 55 respectively integrates distance pulse data measured with the wheel speed sensor 16 and angular acceleration data measured with the gyro 18, and calculates a position (X´, Y´) of the moving body moved from an initial position (X, Y) by integrating the distance data and the angle data during one fixed cycle time obtained by the above calculation. Furthermore, in order to set an initial value of advance direction of the moving body, a relationship of an angle data provided from the gyro 18 and an absolute direction is set by using the directional data provided from the magnetic compass 17.

Furthermore, the present position arithmetic means 55 outputs current position information after having revised the sensor data with the position data provided from the GPS receiver 19 by a predetermined cycle time, thereby a sensor error to be accumulated is canceled by integrating the data provided from the sensor as stated the above.

Generally speaking, in the present position information provided in this way, error of the sensor may be still contained. On this account in order to raise position accuracy furthermore, a next map match attention is performed by the map match processing means 56.

The map match processing compares a road data contained in the map around the current position read in by a data read-in means 57 with a traveling trace obtained from the current position arithmetic means 55, thereby the current position is processed to match to the road where the mutual shape relation becomes highest . By applying this map match processing in most case, the current position comes to correspond with the traveling road and the present position information may be output accurately.

The user operation analysis means 50 receives various operations requested from the user with the input unit 15, and controls the each unit contained in the arithmetic processing department 10 so as to execute the processing corresponding to the request of the user.

For example, when the user requests the course guidance to the goal position, a processing to operate a path from the current goal position to the goal position is requested to a path account means 51, and the information to guide path to course guidance means 52 is requested to be shown to the user. When the user requests a scroll operation of the map which is displayed through the input unit 15 furthermore, a scroll display of the map domain designated is requested to a map display means 54.

The path account means 51 decides an guidance path between two spots by retrieving a node connecting an interval between two spots (the present position and goal position) designated using Dijkstra algorithm.

When determining the path, for example, a path in which the distance between two spots becomes shortest, a course by which it becomes possible to arrive with a shortest time, a path by which a cost for it becomes the most economical etc., are provided by using different retrieval conditions.

The course guidance means 52 compares a link information of guidance path obtained by the path account means 51 with the present position information obtained by the position arithmetic means 55 and the map match processing means 56, and notifies to the user whether the car should turn to right or left, or go straight with a sound by using the sound input and output unit 14 before passing an intersections or by displaying the course for the car on the map on the display unit 11.

The menu displaying means 58 receives a command output from the user operation analysis means 50, and the command for displaying various kinds of a requested menu is sent to the graphics processing means 59.

The arithmetic processing department 10 has a data read-in means 57, a graphics processing means 59, a map display domain setting means 53, and a map display means 54 furthermore.

The map display domain setting means 53 sets a map domain that should be displayed according to an algorithm determined beforehand from the present position of the moving body output, from the map match processing means 56, or from a scroll information about a scroll direction corresponding to scroll operation input through the user operation analysis means 50.

The data read-in means 57 selects to read out the map data of the display domain which is set from the map memory 12.

The map display means 54 sends a command to display a designated object for the map data read out, with a designated contraction scale, in a state keeping a designated direction to an upper direction of the display unit 11, to a graphics processing means 59.

A graphics processing means 59 receives the display command formed by the map display means 54 and the menu displaying means 58, and applies the graphics image in the VRAM 36. The graphics image applied to the VRAM is managed with a collar numbering, and after being converted into RGB corresponding to the collar numbering with the collar pallet 37, it is displayed by the display unit.

As shown in figure 6, the arithmetic processing department 10 comprises a retrieval range setting means 60, a received data analysis means 61, an icon setting means 62, an icon display position setting means 63 and an icon display means 64 furthermore, as a processing means in a navigation system to optimize amount of the information to be communicated and to display the information received intelligibly in this invention.

The retrieval range setting means 60 sets one or

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