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 JPH05-264711.

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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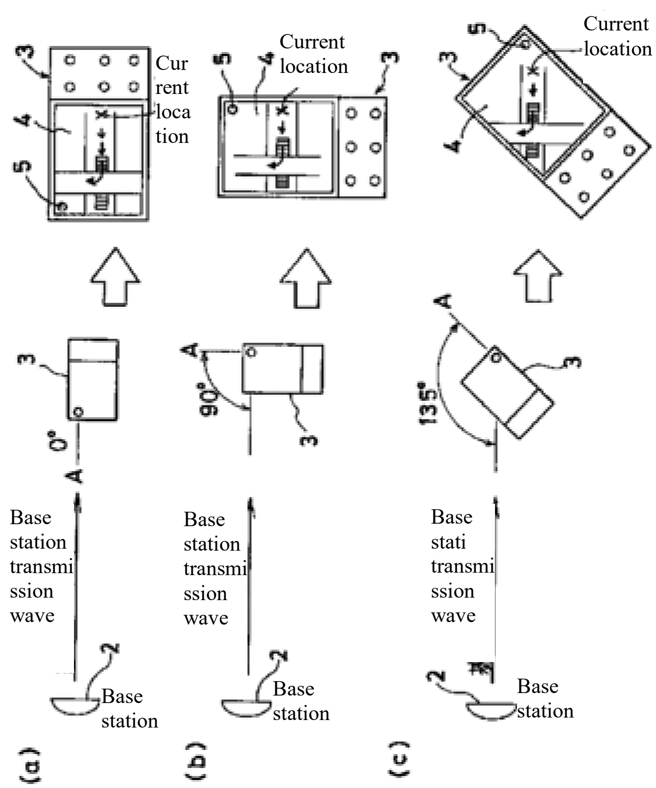
(54) [Title of Invention] ON-PREMISES GUIDE SYSTEM USING MILLIMETER WAVE RADIO

(57) [Abstract]

[Purpose] To provide an on-premises guide system that enables a route to a destination to be accurately and quickly grasped in the premises of a structure such as a station, airport, and the like.

[Constitution] Corrects the relative angle between a reference direction A set in advance for a display device 3 and a reception direction of a base station transmission wave issued from a base station 2, and displays a guide map on a display part 4 of the display device 3.



[Scope of Patent Claims]

[Claim 1] An on-premises guide system by millimeter wave radio, the guide system composed of a base station, installed in advance at a plurality of locations in a premises of a structure, comprising a transmission and reception function by a highly directional millimeter wave; and a transmission and reception terminal capable of transmission and reception with this base station by millimeter wave, wherein

the transmission and reception terminal is provided with guide map display means for displaying a guide map in a substantially horizontal direction based on guide map data of the point where the transmission and reception terminal is located and the surroundings; relative angle detection means for detecting an angle on a substantially horizontal plane formed by a reference direction predetermined with respect to the transmission and reception terminal and a transmission wave from the receiving base station; and guide map data correction means for correcting the guide map data of the point where the transmission and reception terminal is located and the surroundings based on detected information of the relative angle detection means, and for making the real environment of the point where the transmission and reception terminal is located and the surroundings relatively equal to a simulated environment of the guide map displayed on the transmission and reception terminal.

[Detailed Description of the Invention]

[0001]

[Industrial Applicability] The present invention relates to a guide system for performing navigation by millimeter wave radio in the premises of structures such as airports and train stations.

[0002]

[Prior Art] Using the floor plan of a premises prepared in advance and determining the direction based on the guidance display provided on a wall or pillar of the premises in order to arrive at a desired platform, boarding gate, and the like when using the premises of an unknown structure such as a train station, airport, and the like when travelling, on business, and the like is typical.

[0003]

[Problem to be Solved by the Invention] However, at major train stations and international airports in large metropolitan areas with complicated structures, appropriate guidance displays may not always be displayed at short intervals, and it may be difficult to find guidance displays. Furthermore, the simulated environment described in a guide map or the like prepared in advance may differ from the actual real environment, and erroneously recognizing a corresponding relationship between the simulated environment displayed on the guide map and the real environment may cause a misunderstanding of the direction or course of the road. In such a case, a delay in reaching the destination results in failure to make a connection in a short time, ending in missing a desired train or flight, which is a major disadvantage for users of the premises.

[0004] Therefore, it has been desired to develop an on-premises guide system that enables a route to a destination to be accurately and quickly grasped without relying on a guide display plate or the like installed in the premises of a structure such as a train station.

[0005]

[Means for Solving the Problem] In light of the foregoing, the present invention is a guide system composed of a base station

(2), installed in advance at a plurality of locations in a premises of a structure and provided with a transmission and reception function by a highly directional millimeter wave; and a transmission and reception terminal (for example, a display device 3) capable of transmission and reception with this base state (2) by millimeter wave, wherein the transmission and reception terminal (3) is provided with guide map display means (18) for displaying a guide map in a substantially horizontal direction based on guide map data of the point where the transmission and reception terminal (3) is located and the surroundings; relative angle detection means (16) for detecting an angle on a substantially horizontal plane formed by a reference direction (A) predetermined with respect to the transmission and reception terminal (3) and a transmission wave from the receiving base station (2); and guide map data correction means (17) for correcting the guide map data of the point where the transmission and reception terminal (3) is located and the surroundings based on detected information of the relative angle detection means (16), and for making the real environment of the point where the transmission and reception terminal (3) is located and the surroundings relatively equal to a simulated environment of the guide map displayed on the transmission and reception terminal.

[0006]

[Effect] The processing speed of transmission and reception performed between the base station and transmission and reception terminal improves since transmission and reception is performed by the base station and the transmission and reception terminal with a fast transmission speed millimeter wave. Since transmission and reception are performed between the base station and the transmission and reception terminal by a highly directional millimeter wave, the transmission and reception terminal can receive the transmission wave of the base station from only a fixed direction. As described above, the transmission and reception terminal that has received the transmission wave of the base station detects an angle formed by the reference direction and the direction of the reception wave by the relative angle detection means, the guide map data correction means corrects the guide map data based on the detected angle, then the guide map display means displays the guide map based on the guide map data corrected by the guide map data correction means.

[0007]

[Embodiments] Next, embodiments of the guide system set forth in the present invention will be described in detail based on attached drawings.

[0008] A first embodiment of a guide system on premises by millimeter wave is illustrated in FIG. 1, wherein a control station 1 installed in a control room or the like that comprehensively controls a structure such as a train station or airport is connected to a plurality of a base station 2... capable of transmission and reception, for example, via a transmission cable, while the base station 2... installed in advance at a predetermined interval (for example, at an interval of 5 to 10 meters to a side wall or ceiling wall of the premises, etc.) at an appropriate place in the premises of the structure is made to be capable of transmission and reception with a millimeter wave with a display device 3... as the transmission and reception terminal carried by travelers and the like.

[0009] For example, the control station 1, in addition to the transmission and reception function for enabling two-way communication with the base station 2..., is provided with a transmission and reception management control function for performing analysis and the like of commands issued from the display device 3... via the base station 2..., and is fixedly provided with guide map data and the like relating to the layout of the premises of the structure. Furthermore, the base station 2..., in addition to the transmission and reception function for enabling two-way communication with the control station 1 and the display device 3…, is provided with location information as to where the base station 2 is installed, and the control station 1 can transmit and receive with a specific base station 2 without confusing other base stations 2... based on the location information, and it is also possible to specify the area in which the display device 3 that is transmitting and receiving with the base station 2 is located.

[0010] Moreover, each display device 3..., in addition to the transmission and reception function for enabling transmission and reception with the base station 2... by millimeter wave, is provided with a radio wave detection function for detecting the nearest base station 2 from the location where the display device 3 is located, a guide map display function (to be described later) for displaying a guide map in a substantially horizontal direction based on guide map data (in the present embodiment, it is supplied from the control station 1 via the base station 2) of the area where the display device 3 is located, a relative angle detection means (to be described later) for detecting an angle on a substantially horizontal plane formed by a reference direction predetermined with respect to the display device 3 and a transmission wave from the receiving base station 2, and a guide map data correction means for correcting the guide map data of the area where the display device 3 is located based on detected information of the relative angle detection means, and for making the real environment of the area where the transmission and reception terminal is located relatively equal to the simulated environment of the guide map displayed on the transmission and reception terminal.

[0011] Note that, the present invention is not limited to a configuration such as the above first embodiment in which guide map data in the relevant premises are stored and held in the control station 1, and necessary guide map data is supplied according to a request from the base station 2.... For example, in the second embodiment illustrated in FIG. 2, at least the transmission and reception function, the location information, the guide map data, and the transmission and reception management control function are provided in the base stations 2'..., and two-way communication is performed only between each base station 2' and the display device 3.... In this case, since commands and data can be transmitted and received without the intervention of the control station 1, processing speed and the like can be further improved.

[0012] Furthermore, it may be configured so as to store guide map data in the display device 3 serving as the transmission and reception terminal. For example, it may be configured so that guide map data of the required premises is stored in the display device 3 via a data injection writer from a computer or the like, or a guide map data storage medium such as card-type ROM (IC card, card-shaped magnetic memory or the like), CD-ROM or the like in which guide map data of specific structures is pre-written is prepared, and by replacing the guide map data storage medium, guide map data according to each premises can be supplied to the display device 3.

[0013] Next, an embodiment of the display device 3 will be described based on FIG. 3. This display device 3 is configured from a flat box that is a portable size, having a display part 4 configured from a liquid crystal display or the like on any surface of the body, and an antenna part 5 capable of receiving a millimeter wave issued from the base station 2... over 360 degrees in the horizontal direction when the display part 4 is maintained in a substantially horizontal direction, and an operation button 6 for operating the display

device 3 (regardless of whether it is contact type or touch sensor type) is provided at an appropriate location on the display device 3. Furthermore, a transmission and reception management control function related to communication with the base station 2... and a battery (regardless of whether it is disposable or rechargeable) or the like are provided within the display device 3.

[0014] Note that a hand strap may be attached to the display device 3 body and a dedicated storage case for the display device 3 formed in the shape of a waist pouch or shoulder bag may be provided to increase convenience when carrying the display device 3. Furthermore, when configuring the display part 4 with a liquid crystal display, it is possible to increase visibility of the display part 4 by adding a backlight function. Moreover, it is possible to give various additional values in addition to the transmission and reception function to the display device 3 by providing the display device 3 body with additional functions such as an alarm clock, an AM radio, a television receiver function, and the like. Furthermore, the shape of the display device 3 body, and the arrangement of the display part 4, antenna part 5, and the operation button 6 are not limited to the embodiment of FIG. 3, and for example, it is possible to make the display part bigger (or make the display device 3 body smaller) provided that the operation button is provided on another surface when any other surface of the display device 3 body is the front surface display part.

[0015] As in the foregoing, when various additional functions are provided on the display device 3 body, an operation switch may be appropriately provided to enable control according to each function, yet for example, in the display device 3 illustrated in FIG. 3, the operation button 6 is configured from six kinds of operation switches ① to ⑥ for performing basic operations. The control details of each operation button will be described in the following, ① is a power switch for turning the power source of the display device 3 body on/off. ② is a switch for beginning a radio wave search with the antenna part 5 and displaying the guide map of the area. ③ is a switch for enlarging the display of the area. ④ is a switch for displaying related facilities serving as a target in connection with the area (for example, ticket offices, JR ticket offices, restrooms, ticket barriers, and the like). ⑤ and ⑥ are selection switches for performing a plurality of displays according to any combination of the foregoing ② to ④.

[0016] Note that although this is omitted, a simple keyboard part or the like may be provided in the foregoing operation button 6, whereby destinations (for example, the number of a platform), the number of a train to be used, and the like are input from the keyboard part, and by transmitting the input information to the base station 2..., required information is displayed on the display part 4.

[0017] Next, specific examples of the antenna part 5 will be described based on FIG. 4. An antenna 7 also used for transmission and receipt is stored in a radome 8 through which a millimeter wave can pass, and for example, it is possible to rotate approximately 360 degrees in the substantially horizontal direction with a waveguide 9 as the rotation axis. In order to rotate the antenna 7, a drive gear 11 attached to a drive shaft 10 capable of obtaining a drive output from a drive source such as a small motor and a driven gear 12 are engaged with each other, and the waveguide 9 inserted into the rotational center of the driven gear 12 rotates while driving the motor. Thus, while in a state in which the display part 4 of the display device 3 is held in a substantially horizontal direction, the waveguide 9 that is located in a substantially vertical direction is rotated, the antenna 8 attached to the waveguide 9 rotates approximately 360 degrees in the substantially horizontal direction, therefore it is possible to detect in which direction the base station 2 is located.

[0018] Note that the base station 2... is provided on a side wall or ceiling wall of the premises, therefore the antenna 7 for receiving base station transmission waves issued from any of the base stations 2 can receive transmission waves from diagonally above as well as transmission waves in the horizontal direction. Furthermore, in the embodiment illustrated in FIG. 4, the antenna 7 is a horn antenna, yet for example, the antenna part 5 may be configured using an array antenna, a microstrip antenna, and the like.

[0019] As in the foregoing, while the antenna 7 rotates at an appropriate speed (for example, 100 rotations/minute) based on the driving force of the drive source, the antenna location that can receive the base station transmission wave most strongly is detected, and it is possible to determine that the base station 2 is located in the main beam radiation direction of the antenna 7 at the antenna location. Here, as for the search method for detecting the direction of the base station 2, even if the location where the antenna 7 can receive base station transmission waves at a predetermined level or higher is defined as the direction in which the base station 2 exists, first of all the antenna 7 is rotated once, the maximum level of the base station transmission wave in the meantime is stored, and it is also possible to stop rotation of the antenna 7 at the point where a base station transmission wave equal to the maximum level stored during the next rotation is received.

[0020] Furthermore, there are no limits to when rotation of the antenna 7 is stopped at the location facing the base station 2, and there may be a configuration where rotation of the antenna 7 is continued, and the facing location between the antenna 7 and the base station 2 is determined and updated for each rotation. Moreover, the rotation drive structure of the antenna 7 is not limited to the foregoing embodiment, and any method can be used provided that the transmission direction of base station transmission waves can be searched in a substantially horizontal direction. Furthermore, from the viewpoint of reducing the weight and size of the display device 3 itself, an antenna rotation knob or the like may be provided so that the antenna 7 can be manually rotated, the antenna location where the reception level of the antenna 7 becomes maximum may be confirmed by a level meter, and the location may be set as the facing location between the base station 2 and the antenna 7.

[0021] As in the foregoing, by detecting the direction of the base station 2 with the antenna 7, it is possible to obtain the angle formed by the predetermined standby location of the antenna 7 and the base station detection location, which are determined in advance. For example, as illustrated in FIG. 5, the reception direction at the predetermined standby location of the antenna 7 with respect to the display device 3 body is set as a reference direction A, and a relative angle which is an angle formed by the base station detection direction with respect to the reference direction A can be detected. For example, in FIG. 5(a) the relative angle is 0 degrees, in FIG. 5(b) the relative angle is 90 degrees, and in FIG. 5(c) the relative angle is 135 degrees.

[0022] Also, the display state of the guide map displayed on the display part 4 of the display device 3 is corrected using the relative angle obtained as described above, and the outline thereof will be described below. For example, if the relative angle is 0 degrees, it is displayed as is without performing correction of the guide map data (see FIG. 5(a)), if the relative angle is 90 degrees, the guide map data is corrected and displayed so that the display of the guide map is rotated 90 degrees in the direction in which the relative angle shift occurs (see FIG. 5(b)), and if the relative angle 135 degrees, the guide map data is corrected and displayed so that the display of the 135 degree guide map is rotated in the direction in which the relative angle shift occurs (see FIG. 5(c)).

[0023] By doing this, regardless of the direction in which the person carrying the display device 3 holds the display device 3, it is displayed on the display part 4 of the display device 3 so that the display details of the guide map are in a fixed direction with respect to the base station 2. That is, in the embodiment illustrated in FIG. 5, in order for the angle formed by the main beam radiation direction of the base station transmission wave and the reference direction A in the display device 3 to be zero, when the display part 4 of the display device 3 is held in a substantially horizontal direction, if displayed on the display part 4 of the display device 3 without correcting the guide map data, the guide map data supplied from the base station 2 to the display device 3 is set in advance so that the line connecting the base station 2 and the display device 3 in the real environment becomes parallel to the reference direction A in the simulated environment of the guide map displayed on the display part 4. Therefore, by correcting the guide map data only by an angle on the substantially horizontal plane formed by the reference direction A predetermined with respect to the display device 3 and the transmission wave from the base station 2 being received, it becomes possible to relatively equalize the real environment of the area where the display device 3 is located and the simulated environment of the guide map displayed on the display part 4 of the display device 3.

[0024] Note that even when the guide map data supplied from the base station 2 to the display device 3 is not set in advance in a state in which the transmission direction of the base station 2 is considered, the correction angle is determined in advance as one of the location information of the base station 2 so that the transmission direction of the base station 2 in the simulated environment on the display based on the guide map data and the transmission direction of the base station 2 in the real environment are parallel to each other, the guide map data is corrected in each display device 3 by the correction angle only, and moreover, provided that the angle formed by the reference direction A in the display device 3 and the transmission direction of the base station 2 is corrected, it becomes possible to relatively equalize the real environment in the area where the carrier of the display device 3 is located and the simulated environment on the guide map displayed on the display part 4 of the display device 3.

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