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The name of the invention Mobile position detection method

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It was written in fine detail

1. Name of the invention
Mobile position detection method

2. Claims
1, in the method of detecting the position of a mobile body in the mobile communication method, which communicates with a base station and a mobile body by radio waves,

The mobile device receives radio waves from multiple base stations, finds the range of possible existence of the mobile device corresponding to each receiving level using the equielectric field curve of the received electric field level from each base station obtained beforehand, and detects the position of the mobile device from the overlap of each range

A method of detecting the position of moving objects, which is characterized by.

3. Detailed description of the invention
"Industrial use"

This invention is used in the field of mobile communications.

The present invention relates to a method for detecting the position of a mobile station in a mobile communication system such as a car-phone system, in particular, a method for detecting the position of a mobile station in an area by checking the received electric field level at a mobile station of a base station transmission wave with an electric field strength map.

"Traditional Technology"

In the mobile communication system, which consists of multiple radio zones, such as the automobile telephone system, it is necessary to know the current position of the mobile circumference that moves around a wide area, and to connect the line between the mobile station and the fixed network, etc. The mechanism is explained below using the car telephone system as an example ○

(Method Configuration)

As shown in Figure 19, the radio section of the car telephone system consists of 10 mobile stations, 20 base stations, and 40 mobile communication control stations. Base station 20 is responsible for transmitting radio signals to and from mobile station 10. The mobile communication control station 40 controls multiple base stations and is responsible for the interface with the fixed network.

(Zone Configuration)

In the automobile telephone system, which provides large-capacity nationwide wide-area service, the service area is divided into multiple radio zones 30, as shown in Figure 20, for reasons such as limiting the transmission output of 10 mobile stations and effective use of frequency. a base station 20 is installed in each radio zone 30, and the same frequency is used between the base stations that do not generate interference.

In order to efficiently perform incoming service wherever a mobile station is in the service area, the car phone system divides the service area into multiple areas, and the location of the mobile station is registered on the replacement machine as the location identification unit (also called the location registration area, or the global call area) of the mobile station. it adopts the method of calling only in the area where the called mobile station is located. The location registration area usually corresponds to the control zone described below.

(Radio Channel Configuration)

A mobile station uses multiple radio channels in common and selects a specific radio channel for each call. As shown in Figure 20, the radio channel consists of the communication channel 141, which is used for communication, and the control channel 141, which is used for controlling the allocation of communication channel 141 according to the call request from the subscriber. The control channel consists of the incoming control channel 142, which is used for the incoming call connection to the mobile station IO and the simultaneous notification of control information, and the outgoing control channel 143, which is used for the outgoing call connection from the mobile station IO and the reporting and registration of the status of the mobile station 10.

There are two ways to place the control channel:

① Multiple radio zones are arranged as a single unit, or control zone. That is, there are multiple radio zones in each control zone, and a name radio zone has the same number of incoming and outgoing control channels and the same frequency.

② For the incoming control channel, multiple radio zones are designated as one unit (control zone), and for the outgoing control channel, each radio zone is assigned. That is, the incoming control channel is the same as in the case of ①, but the outgoing control channel is the same

The system depends on the control traffic of each radio zone

How to place the chisel

And so on.

The transmission and reception methods of control signals in ① and ② are shown below. What is it

① For

For control signals from the base station to the mobile station, both the outgoing and incoming control channels are transmitted simultaneously from all base stations in the control zone. This method is called "multiple simultaneous transmission system".

② For

Transmission Control the control signals from a base station to a mobile station of ① Nel are basically the same as in the case of the above. However, control signal 150 from the base station to the mobile station of the incoming control channel consists of signals transmitted simultaneously from all base stations in the control zone (shaded areas in the figure) and signals transmitted separately from each radio zone in turn. these are transmitted from the base station on a regular basis. This system is called "multiple-station simultaneous/sequential transmission system". In Figure 21, 151 is a common information signal to transmit common control information to all radio zones in the control zone, 152 is an incoming information signal to transmit incoming control information to mobile stations, and 153 is a base station information signal to transmit specific information to each radio zone. Common information signal 151 and incoming control information signal 152 are transmitted simultaneously by all base stations in the control zone, but the base station information signal 153 is transmitted by each base station in turn. The base station information signal 153 includes the identification number of the base station.

(Location registration)

It is necessary to detect the current position of the mobile station in order to make or receive a call to a mobile station that is moving, and the position detection and registration for determining the area to call simultaneously is called position logging.

The mobile station remembers the reception control channel number (corresponding to the frequency) used in the control zone throughout the country, and during listening, it selects and receives the incoming control channel with the highest reception level from among these channels, and uses the positional information signal (control zone identification number) contained in the control zone to which it is located

To identify the. When the mobile station switches the incoming control channel by moving the position registration unit (that is, the control zone), if the identification number before the switch and the identification number after the switch are different, the position registration signal is transmitted to the wireless base station by the upstream line of the outgoing control channel.

(Determination of Mobile Localization coil Radio Zone)

In order to assign a call channel to a mobile station when a call is made to or from a mobile station, it is necessary to determine the regional radio zone of the mobile station.

In the Automotive Telephone System, which adopts the "multiple-station simultaneous transmission method", the mobile localized radio zone is determined by comparing the reception level at the base station of the response signal of the mobile station or the call signal from the mobile station.

On the other hand, in the car phone system that adopts the "multiple station simultaneous/sequential transmission method", the mobile station compares the level of the base station information signal included in the control signal from the base station of the incoming control channel to the mobile station, and the mobile station determines the mobile zone by determining that it is located in the zone of the base station that transmits the highest base station information signal.

In this way, in order to connect the line between the mobile station and the fixed network, the base station always registers the location of the mobile station in the control zone unit, and when the mobile station comes and goes, it identifies the local radio zone of the mobile station in order to assign the call channel to the mobile station.

[Problems to be solved by the invention]

However, since the location of the mobile station is determined only by the radio zone, the accuracy of location identification is rough, with a radius of several kilometers to several tens of kilometers (the radio zone in the car phone system is about 3 km to 15 blood). In addition, there was a drawback that it was impossible for the mobile subscriber or the fixed subscriber to know the location of the mobile station, especially the location of the mobile station, because the radio zone of the mobile station was only known in the radio section of the car telephone system.

Furthermore, in recent years, we have been supporting the advancement of information technology in society

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Although the movement of people and goods is becoming more active due to the development of road transportation networks, the need for smooth movement of people and cars is increasing due to the increasing number of road congestion and the range of movement is expanding. For this reason, a V M system (Automatic vehicle Monitoring System) is being developed to constantly monitor the position of moving objects and improve the efficiency of vehicle operation by broadcasting location information wirelessly from signposts, and a 5 GPS (Global Positioning System) is being developed to detect the position of moving objects using satellites. ■ 5 GPS (Global Positioning System) is also being developed. In these systems, the accuracy of position detection is relatively high at several tens of meters, but there is a drawback in that it is necessary to make capital investments such as the installation of signposts or the launch of satellites in addition to terminals on the mobile body side.

The purpose of the present invention is to provide a mobile detection method that can detect the position of a mobile body within a mobile communication method area with a higher accuracy than that of a wireless radio unit by eliminating the aforementioned disadvantage, and can also detect the position of a mobile body in a mobile communication method or its communication counterparty.

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"The way to solve the problem"

In the method of locating a mobile body in a mobile communication method that uses radio waves to communicate between a base station and a mobile body, the present invention receives radio waves from multiple base stations by the mobile body respectively, uses the equelectric field curve of the received electric field level from the customer base station obtained beforehand, and finds the possible range of the mobile body corresponding to the customer reception level, and determines the position of the mobile body from the overlap of the customer range.

[Action]

The principle of the present invention is explained below.

The radio wave transmitted from the base station becomes weaker as it moves away from the base station. Therefore, if the strength of the radio wave received by the mobile station, i.e. the level of the received electric field, it can be estimated to what extent the mobile station exists from the base station. Because the topography around the base station is not uniform and there are various features such as trees and buildings, the equielectric field line of the receiving radio wave of a mobile station is generally not concentric circle around the base station, but if the equielectric field line is drawn by some method, the mobile station will exist somewhere on the equielectric field line corresponding to the receiving electric field level.

Since the direction of the mobile station cannot be determined by just receiving radio waves from one base station, the position of the mobile station can be determined only somewhere on the isoelectric field around the base station. if the radio zones of BU22 and B3 (23) overlap and the mobile station (10) can detect the received electric field level of each base station radio wave, the position of the mobile station (10) can be obtained from the intersection of the equielectric field lines of each base station radio wave.

Normally, it is quite difficult to obtain the exact equielectric field wire in detail, so the position of the mobile station 10 that can be detected is not a point but a certain spread. That is, as shown in the field strength map in Figure 2, if the received field level equals at three base stations B, (21), B2 (22) and B3 (23) 10) are obtained as shown in the figure, if the received field level of B, (21) is 52 dB V/m at the mobile station B, (21), and the base station (22) is 45 dB/z3). the mobile station (10) exists somewhere in the part enclosed by the thick frame in the figure. As the number of base stations that can be received by a mobile station (1 ○) increases, it is possible to narrow the existence range of the mobile station (10) even more.

Based on the above idea, the present invention:

① A mobile object can identify and receive radio waves from multiple transmitting points.

② For each transmission point, a map of the electric field strength of the received electric field level of the moving body of the radio wave from the transmission point is obtained beforehand.

③ The received electric field level and the electric field strength of the mobile object are checked for multiple transmission points, and the position of the mobile object is detected by superimposing the range of possible existence of the mobile object obtained on the electric field strength map. The field strength map can be stored in the memory area of the information processing device, and the processing can be executed by program control.

④ Radio waves from multiple transmitting points are each mobile

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As a method of identification and reception, a service area is composed of multiple radio zones, and a wireless base station is installed in each radio zone, and control signals from the base station to the mobile station are transmitted from each base station individually with the base station number. In the mobile communication system, the mobile station detects the KAKUSHIN electric field level of the base station number and the control signal transmitted by the base station from the base station to the mobile station. Or, when the control signal from the base station to the mobile station is not transmitted from the winter base station individually with the base station number, the radio channel received by the mobile station is switched sequentially, the received electric field level of each radio channel is detected, and the received electric field level of each radio channel is detected by correspondence between the radio channel and the base station transmitting the radio channel signal.

⑤ In the mobile communication system described above, ④ the electric field strength map for each base station is installed at the mobile station, the base station, or the communication counterparty of the mobile station, and the base station number detected by the mobile station and the received electric field of the transmit wave of the base station

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The bell can detect your position on the mobile station, or

The base station number detected by the mobile station and the received electric field level of the base station transmit wave are transmitted to the base station or the communication partner of the mobile station through a communication line, and the location of the mobile station is detected by comparing the received electric field level and the electric field strength map of each base station at the destination.

[Examples]

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The following describes the working example of the present invention by referring to the drawing.

Figure 3 shows the block configuration diagram showing the mobile communication system based on the first working example of the present invention.

The first example is a base station with radio zone 31 6,21, a base station with radio zone 32, a base station B2 22 with radio zone 32, a base station B323 with radio zone 33, and several other radio zones indicated by the dashed line, a mobile communication control station 40 that controls these, a location information center 40 and a location information center that is connected by this mobile communication control station 40 and the first communication line 51

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It contains 60 and multiple location information users 70 and each has a position information receiver 71 connected by a second communication line 52.

There is a mobile station 10 in radio zone 31 of base station 8,21, and wireless zone 32 of base station B $_2$ 22 and wireless zone 33 of base station B323 overlap in radio zone 31, and transmission waves of base station 6,21 Bs22 and B $_3$ 2 3 can be received in mobile station 10. Mobile station 10 is connected to Location Information Center 60 via base station B/1, mobile communication control station 40, and first communication line 50. The field strength map 90 is the same as the one shown in Figure 2. The first communication line 51 is usually a fixed telephone line, but it may be a packet communication line, ISD N line, mobile communication line, etc. by changing the interface conditions between the mobile communication control station 40 and the first communication line 51. The second communication line 52 may be different even if it is the same type of line as the first communication line 51, and the first communication line 51 various communication lines can be considered.

From each base station 6,21, B2 22 and B3 2 3, base station information signals 80 including base station number 81 as shown in Figure 4 are transmitted sequentially from each base station B, 21, B2 22 and B3 23 individually as shown in Figure 5 (a) to (d), and mobile station 10 receives signals as shown in Figure 6.

Figure 7 shows the detailed configuration of the mobile station 10. Mobile station 10 has antenna 11, mobile 12, telephone 13, positional signal detector 14, includes 15 signal array transmitters and 16 modems.

The position information signal detector 14 receives the demodulation signal of the base station information signal 80 from the base station to the mobile station 10 from the mobile device 12, detects the base station number and the received electric field level of the base station information signal transmitted by the base station from the demodulation signal 80 and the wave detection output, and sends the base station number 81 and the received electric field level to the signal array transmitter 15. Signal arrangement transmitter 15 sends the mobile number and position information of mobile station 10, i.e. base station number 81 and received field level to modem 16. Modems 16 modulates the data signal from signal array transmitter 15 and sends it to mobile device 12.

Location Information Center 60 sends location information to mobile station 10

At the request of the or when transmitting location information from mobile station 10 to location information center 60, position information detected by mobile station 10, i.e. base station B, 21, base station number 81 such as B $_2$ 22 and B323, received field level at mobile station 10, and mobile station number 10 itself. call mobile station 10 from the location information center 60, or call location information center 60 from the location information center 10, and send it from mobile station 10 to location information center 60 through the first communication line 51 set between the location information center 10 and location information center 60.

The location information center 60 receives the mobile station number and the location information sent from the mobile station 10 by the location information transmitting and receiving device 61 and determines the location of the mobile station 10 by comparing the location information with the electric field strength map 90.

Finally, the location information center 60 sends the mobile station number and the location of the mobile station to the location information receiving device of the location information user 70 requesting the location information of the mobile station 10 through the second communication line 52 from the position information receiving device 61.

By the way, in the configuration of mobile station 10 in Fig. 7, mobile device 12 originally has a means of detecting the control signal and received electric field level, so by changing the software of mobile device 12, it is possible to have a mobile station 10 with the same means as above, except for modem 16. In this case, the position information signal detector 14 and the signal array transmitter 15 are unnecessary. In addition, if the control channel is used to send the mobile station number and location information to the base station side, the model 16 is unnecessary.

Figure 8 is a block diagram showing the key parts of the mobile communication system based on the second working example of the present invention, and Figure 9 is a block diagram showing the details of the mobile station.

In the first example of Fig. 3, the field strength map 90 is removed from the location information center 60 and installed in the mobile station 10A, and the other examples are the same as the first example.

In this second example, the position detection result at mobile station 10A is used on mobile station 10A side, and the position detection result at mobile station 10A is sent along with the mobile station number to the mobile communication control station 40, the location information center, or the location information user 70.

Fig. IO and Fig. 11 are block configuration diagrams showing the key parts of the mobile communication system based on the third and fourth examples of the present invention, respectively.

In the first example of Figure 3, the electric field strength map 90 is removed from the location information center 60 and installed in the mobile communication control station 40A and the location information user 70A respectively.

In the third and fourth examples, position detection is performed at the mobile communication control station 40A and

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