

To solve this problem it is considered to make the mobile terminal compare reception levels from a plurality of base stations and register its location to a base station that transmits a signal of largest reception level in the area where radio zones overlap. In this method, the mobile terminal can register its location to the nearest base station, so the exchange office can properly control location of the mobile terminal.

However, in this method, if the mobile terminal is in an area where reception levels from neighbouring base stations are nearly equal, the moving mobile terminal may frequently change the base station to be registered location. As a result, it may occur confusion on location control of the mobile terminal.

SUMMARY OF THE INVENTION

It is an object of the present invention to ameliorate one or more of the aforementioned problems.

According to one aspect of the invention there is disclosed a mobile communication system having a plurality of base stations, each of said base stations makes a radio zone, and a mobile terminal that moves in said radio zones and registers location of said mobile terminal to a predetermined base station, wherein

said mobile terminal comprises location registration means for detecting reception levels of signals from said base stations, calculating a difference between a largest reception level and a second largest reception level and registering location of said mobile terminal to a base station having transmitted a signal of said largest reception level when said difference is larger than a present threshold value and said location registration means does not register location of said mobile terminal to a base station having transmitted a signal of said largest reception level when said difference is smaller than said threshold value.

According to another aspect of the invention there is disclosed a mobile communication system having an exchange office, a plurality of base stations, each of said base stations makes a radio zone, and a mobile terminal that moves in a said radio zones, where said mobile terminal registers location of said mobile terminal to a

predetermined base station and said exchange office receives location information of said mobile terminal via said predetermined base station and said exchange office confirms location of said mobile terminal, wherein

said mobile terminal comprises:

means for receiving a plurality of signals from a plurality of base stations;

means for detecting reception levels of said signals, selecting a largest reception level and a second largest reception level from among said reception levels and generating identification information indicating a base station having transmitted a signal of said largest reception level according to selected largest reception level;

means for calculating an absolute value of a difference between said largest reception level and said second largest reception level;

means for comparing said absolute value of said difference and a preset threshold value;

storage means for storing an identifier of a base station having been registered location of said mobile terminal;

means for comparing a base station indicated by said identification information and a base station indicated by said identifier when said absolute value of said difference is larger than said threshold value where said means does not register location of said mobile terminal when said base station indicated by said identification information and said base station indicated by said identifier stored in said storage means are the same, and for registering location of said mobile terminal when said base station indicated by said identification information and said base station indicated by said identifier stored in said storage means are different, where said means does not register location of said mobile terminal when said absolute value of said difference is smaller than said threshold value; and

said exchange office comprises:

location display means having a map indicating divisions of said base stations for displaying and for displaying location of said mobile terminal in a division of said base

station according to a signal from a base station having been registered location of said mobile terminal.

According to still another aspect of the invention there is disclosed a mobile communication system comprising a plurality of base stations, each of said base stations makes a radio zone, and a mobile terminal that moves in said radio zones and registers location of said mobile terminal to a predetermined base station, wherein

said mobile terminal comprises location registration means for detecting reception levels of signals from two base stations, calculating a difference between two reception levels and registering location of said mobile terminal to a base station having transmitted a signal of a larger reception level when said difference is larger than a preset threshold value and said location registration means does not register location of said mobile terminal to a base station having transmitted a signal of a larger reception level when said difference is smaller than said threshold value.

According to still another aspect of the invention there is disclosed a method for registering location of a mobile terminal in a mobile communication system having a plurality of base stations, each of said base stations makes a radio zone, and a mobile terminal that moves in a plurality of radio zones, in said mobile terminal, comprising steps of:

- detecting a plurality of reception levels of a plurality of signals from said base stations;

- selecting a largest reception level and a second largest reception level from among detected reception levels;

- calculating a difference between said largest reception level and said second largest reception level;

- registering location of said mobile terminal to a base station having transmitted a signal of said largest reception level when said difference is larger than a preset threshold value; and

not registering location of said mobile terminal when said difference is smaller than said threshold value in said location registration step.

BRIEF DESCRIPTION OF THE DRAWINGS

This and other objects, features and advantages of the present invention will become more apparent upon a reading of the following detailed description and drawings, in which:

Fig. 1 illustrates a system configuration of a first embodiment;

Fig. 2 is a figure for explaining a signal format;

Fig. 3 is a block diagram of a mobile terminal;

Fig. 4 is a figure showing a typical status of reception levels of signals;

Fig. 5 illustrates a system configuration of a second embodiment; and

Fig. 6 is a figure for explaining a prior art.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

A first embodiment of the present invention is described.

In the first embodiment, two radio zones partially overlap each other.

Fig. 1 illustrates a system configuration to explain the first embodiment of the present invention.

CLAIMS

1. A mobile communication system having a plurality of base stations, each of said base stations makes a radio zone, and a mobile terminal that moves in said radio zones and registers location of said mobile terminal to a predetermined base station wherein

said mobile terminal comprises location registration means for detecting reception levels of signals from said base stations, calculating a difference between a largest reception level and a second largest reception level and registering location of said mobile terminal to a base station having transmitted a signal of said largest reception level when said difference is larger than a present threshold value and said location registration means does not register location of said mobile terminal to a base station having transmitted a signal of said largest reception level when said difference is smaller than said threshold value.

2. The mobile communication system of claim 1, wherein said location registration means calculates an absolute value of said difference between said largest reception level and said second largest reception level and compares said absolute value and said threshold value.

3. The mobile communication system of claim 1, wherein said location registration means does not subsequently register the location of said mobile to a base station if said location is already registered.

4. The mobile communication system of claim 1, wherein said location registration means comprises:

means for receiving a plurality of signals from a plurality of base stations;

means for detecting reception levels of said signals, selecting a largest reception level and a second largest reception level from among said reception levels and generating identification information indicating a base station having transmitted a signal of said largest reception level based on said signal of selected largest reception level;

means for calculating a difference between said largest reception level and said second largest reception level;

means for comparing said difference and a preset threshold value; and

location registration establishment means for registering location of said mobile terminal to a base station indicated by said identification information when said difference is larger than said threshold value, where said location registration establishment means does not register location of said mobile terminal to said base station indicated by said identification information when said difference is smaller than said threshold value.

5. The mobile communication system of claim 4, wherein said location registration means comprises:

storage means for storing an identifier of a base station having been registered location; and

means for comparing a base station indicated by said identification information and a base station indicated by said identifier when said difference is larger than said threshold value, and for registering location of a mobile terminal when said base station indicated by said identification information and said base station indicated by said identifier stored in said storage means are different.

6. The mobile communication system of claim 1, further comprising an exchange office connected with said base stations and for receiving location information of said mobile terminal via a base station having been registered location of said mobile terminal and confirming location of said mobile terminal, wherein

said exchange office comprises location display means having a map indicating divisions of said base stations and for displaying location of said mobile terminal in a division of said base station based on a signal from a base station having been registered location of said mobile terminal.

7. A mobile communication system having an exchange office, a plurality of base stations, each of said base stations makes a radio zone, and a mobile terminal that moves in a said radio zones, where said mobile terminal registers location of said mobile terminal to a predetermined base station and said exchange office receives location

information of said mobile terminal via said predetermined base station and said exchange office confirms location of said mobile terminal, wherein

said mobile terminal comprises:

means for receiving a plurality of signals from a plurality of base stations;

means for detecting reception levels of said signals, selecting a largest reception level and a second largest reception level from among said reception levels and generating identification information indicating a base station having transmitted a signal of said largest reception level according to selected largest reception level;

means for calculating an absolute value of a difference between said largest reception level and said second largest reception level;

means for comparing said absolute value of said difference and a preset threshold value;

storage means for storing an identifier of a base station having been registered location of said mobile terminal;

means for comparing a base station indicated by said identification information and a base station indicated by said identifier when said absolute value of said difference is larger than said threshold value where said means does not register location of said mobile terminal when said base station indicated by said identification information and said base station indicated by said identifier stored in said storage means are the same, and for registering location of said mobile terminal when said base station indicated by said identification information and said base station indicated by said identifier stored in said storage means are different, where said means does not register location of said mobile terminal when said absolute value of said difference is smaller than said threshold value; and

said exchange office comprises:

location display means having a map indicating divisions of said base stations for displaying and for displaying location of said mobile terminal in a division of said base

station according to a signal from a base station having been registered location of said mobile terminal.

8. A mobile communication system comprising a plurality of base stations, each of said base stations makes a radio zone, and a mobile terminal that moves in said radio zones and registers location of said mobile terminal to a predetermined base station, wherein

said mobile terminal comprises location registration means for detecting reception levels of signals from two base stations, calculating a difference between two reception levels and registering location of said mobile terminal to a base station having transmitted a signal of a larger reception level when said difference is larger than a preset threshold value and said location registration means does not register location of said mobile terminal to a base station having transmitted a signal of a larger reception level when said difference is smaller than said threshold value.

9. The mobile communication system of claim 8, wherein said location registration means does not register location of said mobile terminal when said mobile terminal had registered location to a base station having transmitted a signal of a larger reception level, even if said difference is larger than said threshold value.

10. The mobile communication system of claim 8, wherein said location registration means comprising:

means for receiving two signals from two base stations;

means for detecting reception levels of said signals;

means for calculating a difference between two reception levels of two signals from among said signals;

means for comparing said difference and a preset threshold value;

storage means for storing an identifier of a base station having been registered location of a mobile terminal;

means for comparing a base station having transmitted a signal of a larger reception level and a base station indicated by said identifier when said difference is larger than

said threshold value where said means does not register location of said mobile terminal when said base station having transmitted a signal of a larger reception level and said base station indicated by said identifier are the same, and for registering location of a mobile terminal to a base station having transmitted a signal of a larger reception level when said base station having transmitted a signal of a larger reception level and said base station indicated by said identifier stored in said storage means are different, where said means does not register location of said mobile terminal when said difference is smaller than said threshold value.

11. The mobile communication system of claim 8 further comprising an exchange office connected with said plurality of base stations and receiving location information of said mobile terminal via a base station having been registered location of said mobile terminal and confirming location of said mobile terminal, wherein

said exchange office comprises location display means having a map indicating divisions of said base stations and for displaying location of said mobile terminal in a division of said base station according to a signal from a base station having been registered location of said mobile terminal.

12. A method for registering location of a mobile terminal in a mobile communication system having a plurality of base stations, each of said base stations makes a radio zone, and a mobile terminal that moves in a plurality of radio zones, in said mobile terminal, comprising steps of:

detecting a plurality of reception levels of a plurality of signals from said base stations;

selecting a largest reception level and a second largest reception level from among detected reception levels;

calculating a difference between said largest reception level and said second largest reception level;

registering location of said mobile terminal to a base station having transmitted a signal of said largest reception level when said difference is larger than a preset threshold value; and

not registering location of said mobile terminal when said difference is smaller than said threshold value in said location registration step.

13. The method for registering location of a mobile terminal in a mobile communication system of claim 12, wherein said location registration step further comprises steps of:

confirming whether said base station having transmitted a signal of largest reception level is registered location of said mobile terminal; and

registering location of said mobile terminal to said base station when location of said mobile terminal has not been registered, where location registration to said base station is not conducted when location registration has been done already.

14. The method for registering location of a mobile terminal in a mobile communication system of claim 12, wherein said difference of reception levels is an absolute value of a difference between a largest reception level and a second largest reception level.

15. The method for registering location of a mobile terminal in a mobile communication system of claim 12, wherein said step of location registration is a step of locating registration to said base station by using identification information, that is included in said signals, indicating a base station having transmitted said signal.

16. The method for registering location of a mobile terminal in a mobile communication system of claim 12, further comprising a step of displaying location of said mobile terminal in a division of said base station on a map indicating divisions of said base stations in said exchange office based on a signal from a base station having been registered location of said mobile terminal.