A METHOD, DEVICE AND SYSTEM FOR LOCATING A VEHICLE

TECHNICAL FIELD

The invention relates to the location technology field and more particularly, to a method, device and system for locating a vehicle.

BACKGROUND OF THE INVENTION

The application of a locating system in vehicle management is defined as vehicle locating with which specific position of a vehicle can be obtained precisely.

There are two types of vehicle locating methods in the prior art. One is well-known vehicle locating method by using the GPS locating system. The other is vehicle locating method by using technology of dead reckoning. Specifically, the later is that, in case that a current location of a vehicle is known, next location of the vehicle is reckoned by measuring distance and direction the vehicle moves toward.

However, both the above methods have shortcomings. Firstly, the vehicle locating method by GPS is invalid in precise locating a vehicle in an area without signal, for example, in a tunnel, high building and etc. Secondly, because next location of a vehicle is reckoned by current location of the vehicle, distance and direction of the vehicle moving toward, the vehicle locating method by dead reckoning incurs errors and with the errors being accumulated, it results in an un-precise location of the vehicle.

SUMMARY OF THE INVENTION

In order to solve the problem of un-precise location of a vehicle, a method, a device and a system for locating a vehicle are provided.

A method for locating a vehicle is provided in the invention, which is applied in a vehicle locating device comprising a controller and a first dedicated short range communication（DSRC）module wherein the controller comprises a determining module and a judging module, and it includes that

the determining module determines location information of the vehicle locating device;

the judging module judges whether a current vehicle installing an OBU is in a communication range being preset by the first DSRC module, and if yes, the first DSRC module sends the location information to a second DSRC module being carried by the OBU so that the OBU of the current vehicle determines location of current vehicle.

Preferably, the method further includes that an adjusting module adjusts communication range of the first DSRC module by adjusting transmitting power of the first DSRC module.

Preferably, that the determining module determines location information of the vehicle locating device includes that the determining module receives location information being computed by a Real - time kinematic(RTK) device for the vehicle locating device; and

the determining module determines the received location information as the location information of the vehicle locating device.

Preferably, that the determining module determines location information of the vehicle locating device includes that the determining module obtains longitude, latitude and course of the vehicle

locating device; and

the determining module determines the longitude, latitude and course as the location information of the vehicle locating device.

Preferably, that the determining module determines location information of the vehicle locating device includes that the determining module obtains a location flag of the vehicle locating device; and

the determining module determines the location flag as the location information of the vehicle locating device.

A vehicle locating device is further provided by the invention, including a controller and a first DSRC module in which the controller includes a determining module and a judging module and specifically the determining module is for determining location information of the vehicle locating device, the judging module is for judging whether a current vehicle installing an OBU is in a communication range being preset by the first DSRC module, and the first DSRC module is for sending the location information to a second DSRC module being carried by the OBU so that the OBU of the current vehicle determines location of the vehicle.

Preferably, the device further includes an adjusting module for adjusting communication range of the first DSRC module by adjusting transmitting power of the first DSRC module.

Preferably, the determining module includes a receiving sub-module for receiving location information computed by a RTK device for the vehicle locating device and a first determining sub-module for determining the received location information as location information of the vehicle locating device.

Preferably, the determining module includes a first obtaining sub-module for obtaining longitude, latitude and course of the vehicle locating device and a second determining sub-module for determining the longitude, latitude and course as the location information of the vehicle locating device.

Preferably, the determining module includes a second obtaining sub-module for obtaining a location flag of the vehicle locating device and a third determining sub-module for determining the location flag as the location information of the vehicle locating device.

A vehicle locating system is further provided by the invention, including a vehicle locating device and an OBU consisting of a second DSRC module, in which the vehicle locating device is any of the above devices and the OBU is installed on the vehicle.

The invention is applied in a vehicle locating device, including a controller and a first DSRC module, in which the controller includes a determining module and a judging module. The method includes that the determining module determines location information of the vehicle locating device; the judging module judges whether a current vehicle installing an OBU is in a communication range being preset by the first DSRC module, and if yes, the first DSRC module sends the location information to a second DSRC module being carried by the OBU so that the

OBU of the current vehicle determines location of the vehicle. Compared with the vehicle locating method by GPS in the prior art, the invention has an advantage of precisely locating the current vehicle in an area without signal. Compared with the vehicle locating method by dead reckoning in the prior art, the invention has an advantage of precisely locating the current vehicle by correcting errors of location of the vehicle by dead reckoning. In sum, compared with the prior art, the invention has the advantage of precisely locating the vehicle.

DESCRIPTION OF THE ACCOMPANYING DRAWINGS

For clarifying the technical solution of the embodiments in the application, accompanying drawings used for describing the embodiments will be simply introduced as below. Obviously, the below described accompanying drawings are just referred to part of embodiments of the application, and other accompanying drawings will be obtained with these accompanying drawings by a common technician skilled in the art without involving any inventive effort.

Figure 1 is a flow chart of a method for locating a vehicle in Embodiment 1 of the invention;

Figure 2 is a flow chart of a method for locating a vehicle in Embodiment 2 of the invention;

Figure 3 is a flow chart of a method for locating a vehicle in Embodiment 3 of the invention;

Figure 4 is a structural diagram of a device of locating a vehicle in Embodiment 4 of the invention;

Figure 5 is one of structural diagrams of Determining module 4011 in Embodiment 4 of the invention;

Figure 6 is one of structural diagrams of Determining module 4011 in Embodiment 4 of the invention;

Figure 7 is one of structural diagrams of Determining module 4011 in Embodiment 4 of the invention; and

Figure 8 is a structural diagram of the device of locating a vehicle in Embodiment 4 of the invention.

DETAILED EMBODIMENTS OF THE INVENTION

In the vehicle locating field, the method for locating a vehicle with GPS technology has a locating corner. The invention can eliminate the locating corner so as to perfect the GPS locating technology step by step. In the meantime, the invention has an advantage of correcting a result of locating a vehicle by dead reckoning technology. Before the step of locating a vehicle in the invention, a vehicle locating device is installed on both sides of a road, specifically on road lamps along both sides of a road, and an OBU is installed on the vehicle to be located and the vehicle locating process is completed via communication between the vehicle locating device and the OBU.

A clear and complete description will be given to the technical solution of the embodiments in the application in accompanying with the drawings of the embodiments in the invention. Obviously, the described embodiments are just part of embodiments of the application, not the whole embodiments. Based on the embodiments of the application, all other embodiments obtained by a technician skilled in the art without involving an inventive effort should fall in the scope of the protection of the application.

Embodiment 1

A solution of the embodiment is applied in a vehicle locating device. The vehicle locating device

includes a controller and a first DSRC module. The controller includes a determining module and a judging module. Specifically, the controller included in the vehicle locating device is implemented by a RSU (road side unit).

As shown in Figure 1, a flow chart of a method for locating a vehicle is provided in embodiment 1 of the invention. The embodiment includes following steps.

Step 101, the determining module determines location information of the vehicle locating device.

In the embodiment, it is a first requirement to determine location where the vehicle locating is installed, which is obtaining location information of the vehicle locating device.

In practice, a plurality of vehicle locating devices are required to install on both sides of a road, specifically on both sides of a road unable to implement location with GPS technology or on both sides of a road down a high building with weak GPS signal.

The detailed installation rule can be set out with requirement of a user and whichever rule is selected to install the vehicle locating device is irrelevant to implementation of the embodiment.

In the embodiment, the determining module in the vehicle locating device can determine location information of the vehicle locating device with location information computed by a RTK device for the vehicle locating device. Specifically, the location information can include longitude, latitude and course of installed vehicle locating device and a first DSRC module in the installed vehicle locating device is able to transmit radio frequency signal which is modulated with location information of the vehicle locating device.

Specifically, the determined location information can also be a location flag of the installed vehicle locating device. For example, if two roads are respectively a major road and a relief road, the vehicle locating technology in the prior art is difficult to determine whether a current vehicle is on a major road or a relief road. However, in the embodiment, vehicle locating devices are pre-installed on both sides of the major road or the relief road and therefore location flag of the installed vehicle locating device is determined as the location information of the vehicle locating device. Specifically, if the vehicle locating device is installed on the major road, the location flag is major road.

Specifically, the installed vehicle locating device includes the first DSRC module for communication with a second DSRC module included in the OBU by transmitting and receiving radio frequency signal.

Step 102, the judging module judges whether current vehicle installing the OBU is located in a communication range being preset by the first DSRC module, and if yes, Step 103 is executed.

In the embodiment, an OBU including the second DSRC module is pre-installed on the vehicle to be located and the second DSRC module is used for receiving radio frequency signal carried with the location information of the vehicle locating device, sent by the first DSRC module.

In practice, the communication range of the first DSRC module can be preset. Specifically the communication range can be adjusted, for example, to 1.5 meter, by adjusting strength of the transmitting power of the first DSRC module.

In practice, whether the current vehicle is in the communication range of any of first DSRC modules is determined by communication between the first DSRC module and the DSRC module in the current vehicle, if it is known that the current vehicle has been in the preset communication range from the communication between the first DSRC module and the second

DSRC module, Step 103 is executed.

Step 103, the first DSRC module sends the location information to the second DSRC module carried by the OBU so that the OBU of the current vehicle locates the vehicle.

In practice, in case that the current vehicle has been in the communication range being preset by any of the first DSRC modules, the first DSRC module sends location information of the vehicle locating device to the second DSRC module being carried by the current vehicle.

Specifically, both the first DSRC module and the second DSRC module send and receive the location information in the form of radio frequency signal.

In the embodiment, because the location information of the installed vehicle locating device is certain, location information of the vehicle in the communication range of the first DSRC module is approximately certain, almost equaling to the location information of the vehicle locating device, and the errors between the two is dependent on setting of the communication range.

The embodiment is applied in a vehicle locating device. The device includes a controller and a first DSRC module. The controller includes a determining module and a judging module. The embodiment includes that the determining module determines location information of the vehicle locating device; the judging module judges whether the current vehicle carried with an OBU is in a communication range being preset by the first DSRC module, and if yes, the first DSRC module sends the location information to a second DSRC module carried by the OBU so that the OBU of the current vehicle determines location of the vehicle. Compared with the prior art, the invention has an advantage of precise location of a vehicle.

Embodiment 2

The embodiment is application oriented. In the CBD (central business district) crowed with high buildings, due to shield of the high buildings, GPS location signal is unstable and therefore vehicle locating devices are installed in the seriously shielding area of CBD. When moving into a communication range of a first DSRC module included in the vehicle locating device, the vehicle obtains location information of the vehicle locating device and according to which keeps locating the current vehicle till GPS signal turns well.

The embodiment is also used in a vehicle locating device. The device includes a controller and a first DSRC module and the controller includes a determining module and a judging module.

As illustrated in Figure 2, a flow chart of a method for locating a vehicle is provided in Embodiment 2 of the invention.

The embodiment includes the following steps.

Step 201, the determining module determines location information of the vehicle locating device being installed in a seriously shielding area of CBD.

Because of serious shielding in the CBD, a vehicle cannot be located with GPS locating technology, and therefore in the embodiment, a vehicle locating device is installed in the serious shielding area and location information of the vehicle locating device is determined via a RTK device. The location information includes longitude, latitude and course of the vehicle locating device.

Specifically, the installed vehicle locating device includes a first DSRC module for communication with a second DSRC module carried with the vehicle.

In practice, a plurality of vehicle locating devices can be installed in some serious shielding areas of the CBD according to strength of GPS signal at a location where the vehicle locating devices are,

for example, in an area of weak GPS signal or in an area without GPS signal.

Step 202, a communication range of the first DSRC module is set by adjusting transmitting power of the first DSRC module.

In the embodiment, communication range of the first DSRC module is set by adjusting transmitting power of an installed first DSRC module.

Specifically, the communication range of the first DSRC module included in the vehicle locating module being installed in some serious shielding area of the CBD can be set to 1 meter.

Step 203, the judging module judges whether the current vehicle with an OBU is in the communication range, and if yes, step 204 is executed.

In the embodiment, the first step is installing the OBU including the second DSRC module on the vehicle to be located and the second step is judging whether the current vehicle is in the preset communication range by communication between the second DSRC module and the first DSRC module in the form of radio frequency signal and if yes, going to step 204.

If the current vehicle is not in the preset communication range, it keeps moving as normal till the current vehicle enters into the preset communication range, and step 204 is executed.

Step 204, the first DSRC module sends the location information to the second DSRC module being carried by the OBU so that the OBU of the current vehicle determines location of the vehicle.

In the embodiment, if the current vehicle is in the preset communication range, the first DSRC module corresponding to the communication range sends its location information to the second DSRC module corresponding to the current vehicle so as to determine location of the current vehicle.

Specifically, the location information is transmitted between the first DSRC module and the second DSRC module in the form of radio frequency signal.

In the embodiment, the solution of locating a vehicle by installing a vehicle locating device in some serious shielding areas of the CBD overcomes difficulty in locating a vehicle due to weak GPS signal or non-signal. Compared with the vehicle locating method by GPS in the prior art, the embodiment has the advantage of precise locating a vehicle in an area without signal or with weak signal.

Embodiment 3

The embodiment is also application oriented. In the embodiment, in a highway with major road and relief road in short distance, such as a distance less than 5 meters, while the GPS location precision is about 10 meters, the simple GPS location technology is unable to differ a major road from a relief road in the highway. If the vehicle locating device is installed on a relief road, that a second DSRC module included in an OBU carried by the current vehicle receives a radio frequency signal being sent by a first DSRC module contained in the installed vehicle locating device represents that the current vehicle is moving on a relief road; or else, it represents that the current vehicle is moving on a major road.

The embodiment is also used in a vehicle locating device. The device includes a controller and a first DSRC module in which the controller includes a determining module and a judging module.

As shown in Figure 3, a flow chart of a method for locating a vehicle is provided in Embodiment 3 of the invention.

The embodiment includes following steps.

Step 301, the determining module determines location information of the vehicle locating device

installed on a relief road of a highway.

In the embodiment, it is difficult to locate a vehicle with GPS location technology in the prior art because of a short distance between the major road and the relief road.

In practice, the vehicle locating device is pre-installed on relief road of a highway and a location flag of the vehicle locating device is determined as its location information. Specifically, the location flag is in a form of radio frequency signal.

In practice, because communication range being preset by the first DSRC module included by the vehicle locating device makes the vehicle locating device only communicate with a vehicle moving on the relief road, that the current vehicle receives a location flag in a form of radio frequency signal, sent by the vehicle location signal shows that the current vehicle is moving on the relief road.

Step 302, a communication range of the first DSRC module is set by adjusting transmitting power of the first DSRC module.

Step 303, the judging module judges whether the current vehicle installing OBU is in the communication range, and if yes, step 304 is executed.

What is described in steps 302-303 is the same as that in steps 202-203 and therefore details of it are omitted herein.

Step 304, the first DSRC module sends the location information to a second DSRC module carried by the OBU so that the OBU of the current vehicle determines location of the vehicle.

In the embodiment, in case that the current vehicle is in the preset communication range, the first DSRC module contained in the vehicle locating device which is pre-installed on a relief road sends location information of the vehicle locating device to the second DSRC module contained in the current vehicle and the current vehicle determines that it is on the relief road with the location information.

Specifically, the location information is in the form of radio frequency signal sent by the first DSRC module and in case that the vehicle receives the radio frequency signal sent by the first DSRC module, it indicates that the vehicle is on a relief road.

The embodiment overcomes shortcoming of failed location on a major road or a relief road with GPS location technology by installing a plurality of vehicle locating devices on a relief road nearby the major road.

Embodiment 4

As shown in Figure 4, a structural diagram of a device of locating a vehicle is provided in embodiment 4 of the invention. The embodiment includes a controller 401 and a first DSRC module 402 in which the controller 401 includes a determining module 4011 and a judging module 4012.

The determining module 4011 is for determining location information of the vehicle locating device.

As shown in Figure 5, one of structural diagrams of the determining module 4011, the determining module 4011 includes a receiving sub-module 501 for receiving location information

computed by a RTK device for the vehicle locating device and a first determining sub-module 502 for determining the received location information as location information of the vehicle locating device.

As shown in Figure 6, one of structural diagrams of the determining module 4011, the determining module includes a first obtaining sub-module 601 for obtaining longitude, latitude and course of the vehicle locating device and a second determining sub-module 602 for determining the longitude, latitude and the course as the location information of the vehicle locating device.

As shown in Figure7, one of structural diagrams of the determining module 4011, the determining module 4011 includes a second obtaining sub-module 701 for obtaining a location flag of the vehicle locating device and a third determining sub-module 702 for determining the location flag as the location information of the vehicle locating device.

The judging module 4012 is for judging whether the current vehicle installing the OBU is in communication range being preset by the first DSRC module.

The first DSRC module 402 is for sending the location information to a second DSRC module carried by the OBU so that the OBU of the current vehicle determines the location of the current vehicle.

As shown in Figure 8, a structural diagram of the vehicle locating device, the device in Figure 4 is included in it. The controller 401 in Figure 8 further includes an adjusting module for adjusting communication range of the first DSRC module by adjusting transmitting power of the first DSRC module.

Embodiment 5

A vehicle locating system is provided in the invention, which includes a vehicle locating device and an OBU containing a second DSRC module. The vehicle locating device is any device shown in Figures 4-8 and the OBU is installed on the vehicle.

In the embodiment, the vehicle locating device is installed on both sides of a road with weak GPS signal and the OBU containing the second DSRC module is installed on the vehicle to be located. A communication range of the first DSRC module in the vehicle locating device is preset and in case that the current vehicle moves in the communication range, the first DSRC module sends location information of the vehicle locating device to the second DSRC module in the form of radio frequency signal, while in case that the second DSRC module receives the location information of the vehicle locating device, the vehicle is located according to the location information.

The embodiment is applied in a vehicle locating device. The device includes a controller and a first DSRC module in which the controller includes a determining module and a judging module. The embodiment includes that the determining module determines location information of the vehicle locating device; the judging module judges whether the current vehicle installing an OBU is in a communication range being preset by the first DSRC module, and if yes, the first DSRC module sends the location information to a second DSRC module carried by the OBU so that the OBU of the current vehicle determines location of the vehicle. Compared with the GPS vehicle locating method in the prior art, the embodiment has an advantage of precise location of the current vehicle. Compared with the vehicle locating method by dead reckoning in the prior art, the embodiment has an advantage of precise location of the current vehicle and correction of

errors from vehicle locating method by dead reckoning. In sum, compared with the prior art, the embodiment precisely locates a vehicle.

Because the device embodiment is basically corresponding to the method embodiment, the counterpart of the device embodiment can be obtained from description of the method embodiment. The above described device embodiments are only illustrative, in which the unit described as separate components may be or not separated physically and the part displayed as a unit can be or not a physical unit which can be located in one position or distributed over more networking units. Part or the whole modules can be selected as required to realize purpose of the embodiments and a common technician in the prior art should understand and implement it without involving any inventive effort.

It is noted that, in the application, terms such as first, second and the like are only used to differ an entity or operation from another entity and operation, not a requirement or indication of any practical relation or order among these entities or operations. Moreover, terms “include” and “contain” or other variations are intended to cover non-exclusive inclusion which make a process, method, product or device include a plurality of factors, not only those mentioned factors, but also other factors not being listed directly or factors inherent with the process, method, product or device. In case of less limits, the factor limited by a sentence "including a….” is not exclusive to other same factor in the process, method, product and device.

The above-mentioned is a detailed description of the method and device of locating a vehicle provided by the embodiments of the invention. Special examples are applied for clarifying the principle and embodiments of the invention. The description of the above embodiments is only for helping understand method and key ideas of the invention and an ordinary technical in the art may make changes in terms of the embodiments and scope of the application in accordance with ideas of the invention. In sum, the summary should not be a limit to the invention.

Claims

1. A method for locating a vehicle, which is applied in a vehicle locating device comprising a controller and a first DSRC module wherein the controller comprises a determining module and a judging module, comprising steps:
   the determining module determines location information of the vehicle locating device;
   the judging module judges whether a current vehicle installing an OBU is in a communication range being preset by the first DSRC module and if yes, the first DSRC module sends the location information to a second DSRC module being carried by the OBU so that the OBU of the current vehicle determines location of the current vehicle.

2. The method of claim 1, wherein it further comprises that
   an adjusting module adjusts the communication range of the first DSRC module by adjusting transmitting power of the first DSRC module.

3. The method of claim 1, wherein the step that the determining module determines location information of the vehicle locating device comprises:
   the determining module receives location information computed by a RTK device for the vehicle locating device; and
   the determining module determines the received location information as the location information of the vehicle locating device.

4. The method of claim 1 or 2, wherein the step that the determining module determines location information of the vehicle locating device comprises:
   the determining module obtains longitude, latitude and course of the vehicle locating device; and the determining module determines the longitude, latitude and course as the location information of the vehicle locating device.

5. The method of claim 1 or 2, wherein the step that the determining module determines location information of the vehicle locating device comprises:
   that the determining module obtains a location flag of the vehicle locating device; and
   the determining module determines the location flag as the location information of the vehicle locating device.

6. A device of locating a vehicle, comprising a controller and a first DSRC module in which the controller comprises a determining module and a judging module and specifically
   the determining module is for determining location information of a vehicle;
   the judging module is for judging whether the current vehicle installing an OBU is in a communication range being preset by the first DSRC module; and
   the first DSRC module is for sending the location information to a second DSRC module carried by the OBU so that the OBU of current vehicle determines its location.

7. The device of claim 6, wherein it further comprises an adjusting module for adjusting the communication range of the first DSRC module by adjusting transmitting power of the first

DSRC module.

8. The device of claim 6, wherein the determining module comprises a receiving sub-module for receiving location information being computed by a RTK device for the vehicle locating device and a first determining sub-module for determining the received location information as the location information of the vehicle locating device.

9. The device of claim 6 or 7, wherein the determining module comprises a first obtaining sub-module for obtaining longitude, latitude and course of the vehicle locating device and a second determining sub-module for determining the longitude, latitude and course as the location information of the vehicle locating device.

10. The device of claim 6 or 7, wherein the determining module comprises a second obtaining sub-module for obtaining a location flag of the vehicle locating device and a third determining sub-module for determining the location flag as the location information of the vehicle locating device.

11. A system of locating a vehicle, comprising a vehicle locating device and an OBU which comprises a second DSRC module, in which the vehicle locating device is any device of claims 6-10 and the OBU is installed on the vehicle.

A METHOD, DEVICE AND SYSTEM FOR LOCATING A VEHICLE

TECHNICAL FIELD

The invention relates to the location technology field and more particularly, to a method, device and system for locating a vehicle.

BACKGROUND OF THE INVENTION

The application of a locating system in vehicle management is defined as vehicle locating with which specific position of a vehicle can be obtained precisely.

There are two types of vehicle locating methods in the prior art. One is well-known vehicle locating method by using the GPS locating system. The other is vehicle locating method by using technology of dead reckoning. Specifically, the later is that, in case that a current location of a vehicle is known, next location of the vehicle is reckoned by measuring distance and direction the vehicle moves toward.

However, both the above methods have shortcomings. Firstly, the vehicle locating method by GPS is invalid in precise locating a vehicle in an area without signal, for example, in a tunnel, high building and etc. Secondly, because next location of a vehicle is reckoned by current location of the vehicle, distance and direction of the vehicle moving toward, the vehicle locating method by dead reckoning incurs errors and with the errors being accumulated, it results in an un-precise location of the vehicle.

SUMMARY OF THE INVENTION

The invention is defined in the independent claims. Some optional features of the invention are defined in the dependent claims.

An exemplary vehicle, a method, a device and a system for locating a vehicle are described.

A exemplary method for locating a vehicle, which is applied in a vehicle locating device comprising a controller and a first dedicated short range communication （DSRC） module wherein the controller comprises a determining module and a judging module, and it includes that

the determining module determines location information of the vehicle locating device;

the judging module judges whether a current vehicle installing an OBU is in a communication range being preset by the first DSRC module, and if yes, the first DSRC module sends the location information to a second DSRC module being carried by the OBU so that the OBU of the current vehicle determines location of current vehicle.

Preferably, the method further includes that an adjusting module adjusts communication range of the first DSRC module by adjusting transmitting power of the first DSRC module.

Preferably, that the determining module determines location information of the vehicle locating device includes that the determining module receives location information being computed by a Real - time kinematic(RTK) device for the vehicle locating device; and

the determining module determines the received location information as the location information of the vehicle locating device.

Preferably, that the determining module determines location information of the vehicle locating device includes that the determining module obtains longitude, latitude and course of the vehicle

locating device; and
the determining module determines the longitude, latitude and course as the location information of the vehicle locating device.
Preferably, that the determining module determines location information of the vehicle locating device includes that the determining module obtains a location flag of the vehicle locating device; and
the determining module determines the location flag as the location information of the vehicle locating device.

An exemplary vehicle locating device is further provided, including a controller and a first DSRC module in which the controller includes a determining module and a judging module and specifically the determining module is for determining location information of the vehicle locating device, the judging module is for judging whether a current vehicle installing an OBU is in a communication range being preset by the first DSRC module, and the first DSRC module is for sending the location information to a second DSRC module being carried by the OBU so that the OBU of the current vehicle determines location of the vehicle.

Preferably, the device further includes an adjusting module for adjusting communication range of the first DSRC module by adjusting transmitting power of the first DSRC module.

Preferably, the determining module includes a receiving sub-module for receiving location information computed by a RTK device for the vehicle locating device and a first determining sub-module for determining the received location information as location information of the vehicle locating device.

Preferably, the determining module includes a first obtaining sub-module for obtaining longitude, latitude and course of the vehicle locating device and a second determining sub-module for determining the longitude, latitude and course as the location information of the vehicle locating device.

Preferably, the determining module includes a second obtaining sub-module for obtaining a location flag of the vehicle locating device and a third determining sub-module for determining the location flag as the location information of the vehicle locating device.

An exemplary vehicle locating system is further provided, including a vehicle locating device and an OBU consisting of a second DSRC module, in which the vehicle locating device is any of the above devices and the OBU is installed on the vehicle.

The invention may be applied in a vehicle locating device, including a controller and a first DSRC module, in which the controller includes a determining module and a judging module. The method includes that the determining module determines location information of the vehicle locating device; the judging module judges whether a current vehicle installing an OBU is in a communication range being preset by the first DSRC module, and if yes, the first DSRC module sends the location information to a second DSRC module being carried by the OBU so that the

OBU of the current vehicle determines location of the vehicle. Compared with the vehicle locating method by GPS in the prior art, the techniques disclosed herein have an advantage of precisely locating the current vehicle in an area without signal. Compared with the vehicle locating method by dead reckoning in the prior art, the current techniques have an advantage of precisely locating the current vehicle by correcting errors of location of the vehicle by dead reckoning. In sum, compared with the prior art, the current techniques have the advantage of precisely locating the vehicle.

DESCRIPTION OF THE ACCOMPANYING DRAWINGS

For clarifying the technical solution of the embodiments in the application, accompanying drawings used for describing the embodiments will be simply introduced as below. Obviously, the below described accompanying drawings are just referred to part of embodiments of the application, and other accompanying drawings will be obtained with these accompanying drawings by a common technician skilled in the art without involving any inventive effort.

Figure 1 is a flow chart of a method for locating a vehicle in Embodiment 1;

Figure 2 is a flow chart of a method for locating a vehicle in Embodiment 2;

Figure 3 is a flow chart of a method for locating a vehicle in Embodiment 3;

Figure 4 is a structural diagram of a device of locating a vehicle in Embodiment 4;

Figure 5 is one of structural diagrams of Determining module 4011 in Embodiment 4;

Figure 6 is one of structural diagrams of Determining module 4011 in Embodiment 4;

Figure 7 is one of structural diagrams of Determining module 4011 in Embodiment 4; and

Figure 8 is a structural diagram of the device of locating a vehicle in Embodiment 4.

DETAILED EMBODIMENTS OF THE INVENTION

In the vehicle locating field, the method for locating a vehicle with GPS technology has a locating corner. The techniques disclosed herein can eliminate the locating corner so as to perfect the GPS locating technology step by step. In the meantime, the techniques disclosed herein have an advantage of correcting a result of locating a vehicle by dead reckoning technology. Before the step of locating a vehicle, a vehicle locating device is installed on both sides of a road, specifically on road lamps along both sides of a road, and an OBU is installed on the vehicle to be located and the vehicle locating process is completed via communication between the vehicle locating device and the OBU.

A clear and complete description will be given to the technical solution of the embodiments in the application in accompanying with the drawings of the embodiments. Obviously, the described embodiments are just part of embodiments of the application, not the whole embodiments. Based on the embodiments of the application, all other embodiments obtained by a technician skilled in the art without involving an inventive effort should fall in the scope of the protection of the application.

Embodiment 1

A solution of the embodiment is applied in a vehicle locating device. The vehicle locating device

includes a controller and a first DSRC module. The controller includes a determining module and a judging module. Specifically, the controller included in the vehicle locating device is implemented by a RSU (road side unit).

As shown in Figure 1, a flow chart of a method for locating a vehicle is provided in embodiment 1. The embodiment includes following steps.

Step 101, the determining module determines location information of the vehicle locating device.

In the embodiment, it is a first requirement to determine location where the vehicle locating is installed, which is obtaining location information of the vehicle locating device.

In practice, a plurality of vehicle locating devices are required to install on both sides of a road, specifically on both sides of a road unable to implement location with GPS technology or on both sides of a road down a high building with weak GPS signal.

The detailed installation rule can be set out with requirement of a user and whichever rule is selected to install the vehicle locating device is irrelevant to implementation of the embodiment.

In the embodiment, the determining module in the vehicle locating device can determine location information of the vehicle locating device with location information computed by a RTK device for the vehicle locating device. Specifically, the location information can include longitude, latitude and course of installed vehicle locating device and a first DSRC module in the installed vehicle locating device is able to transmit radio frequency signal which is modulated with location information of the vehicle locating device.

Specifically, the determined location information can also be a location flag of the installed vehicle locating device. For example, if two roads are respectively a major road and a relief road, the vehicle locating technology in the prior art is difficult to determine whether a current vehicle is on a major road or a relief road. However, in the embodiment, vehicle locating devices are pre-installed on both sides of the major road or the relief road and therefore location flag of the installed vehicle locating device is determined as the location information of the vehicle locating device. Specifically, if the vehicle locating device is installed on the major road, the location flag is major road.

Specifically, the installed vehicle locating device includes the first DSRC module for communication with a second DSRC module included in the OBU by transmitting and receiving radio frequency signal.

Step 102, the judging module judges whether current vehicle installing the OBU is located in a communication range being preset by the first DSRC module, and if yes, Step 103 is executed.

In the embodiment, an OBU including the second DSRC module is pre-installed on the vehicle to be located and the second DSRC module is used for receiving radio frequency signal carried with the location information of the vehicle locating device, sent by the first DSRC module.

In practice, the communication range of the first DSRC module can be preset. Specifically the communication range can be adjusted, for example, to 1.5 meter, by adjusting strength of the transmitting power of the first DSRC module.

In practice, whether the current vehicle is in the communication range of any of first DSRC modules is determined by communication between the first DSRC module and the DSRC module in the current vehicle, if it is known that the current vehicle has been in the preset communication range from the communication between the first DSRC module and the second

DSRC module, Step 103 is executed.

Step 103, the first DSRC module sends the location information to the second DSRC module carried by the OBU so that the OBU of the current vehicle locates the vehicle.

In practice, in case that the current vehicle has been in the communication range being preset by any of the first DSRC modules, the first DSRC module sends location information of the vehicle locating device to the second DSRC module being carried by the current vehicle.

Specifically, both the first DSRC module and the second DSRC module send and receive the location information in the form of radio frequency signal.

In the embodiment, because the location information of the installed vehicle locating device is certain, location information of the vehicle in the communication range of the first DSRC module is approximately certain, almost equaling to the location information of the vehicle locating device, and the errors between the two is dependent on setting of the communication range.

The embodiment is applied in a vehicle locating device. The device includes a controller and a first DSRC module. The controller includes a determining module and a judging module. The embodiment includes that the determining module determines location information of the vehicle locating device; the judging module judges whether the current vehicle carried with an OBU is in a communication range being preset by the first DSRC module, and if yes, the first DSRC module sends the location information to a second DSRC module carried by the OBU so that the OBU of the current vehicle determines location of the vehicle. Compared with the prior art, the techniques disclosed herein have an advantage of precise location of a vehicle.

Embodiment 2

The embodiment is application oriented. In the CBD (central business district) crowed with high buildings, due to shield of the high buildings, GPS location signal is unstable and therefore vehicle locating devices are installed in the seriously shielding area of CBD. When moving into a communication range of a first DSRC module included in the vehicle locating device, the vehicle obtains location information of the vehicle locating device and according to which keeps locating the current vehicle till GPS signal turns well.

The embodiment is also used in a vehicle locating device. The device includes a controller and a first DSRC module and the controller includes a determining module and a judging module.

As illustrated in Figure 2, a flow chart of a method for locating a vehicle is provided in Embodiment 2.

The embodiment includes the following steps.

Step 201, the determining module determines location information of the vehicle locating device being installed in a seriously shielding area of CBD.

Because of serious shielding in the CBD, a vehicle cannot be located with GPS locating technology, and therefore in the embodiment, a vehicle locating device is installed in the serious shielding area and location information of the vehicle locating device is determined via a RTK device. The location information includes longitude, latitude and course of the vehicle locating device.

Specifically, the installed vehicle locating device includes a first DSRC module for communication with a second DSRC module carried with the vehicle.

In practice, a plurality of vehicle locating devices can be installed in some serious shielding areas of the CBD according to strength of GPS signal at a location where the vehicle locating devices are,

for example, in an area of weak GPS signal or in an area without GPS signal.

Step 202, a communication range of the first DSRC module is set by adjusting transmitting power of the first DSRC module.

In the embodiment, communication range of the first DSRC module is set by adjusting transmitting power of an installed first DSRC module.

Specifically, the communication range of the first DSRC module included in the vehicle locating module being installed in some serious shielding area of the CBD can be set to 1 meter.

Step 203, the judging module judges whether the current vehicle with an OBU is in the communication range, and if yes, step 204 is executed.

In the embodiment, the first step is installing the OBU including the second DSRC module on the vehicle to be located and the second step is judging whether the current vehicle is in the preset communication range by communication between the second DSRC module and the first DSRC module in the form of radio frequency signal and if yes, going to step 204.

If the current vehicle is not in the preset communication range, it keeps moving as normal till the current vehicle enters into the preset communication range, and step 204 is executed.

Step 204, the first DSRC module sends the location information to the second DSRC module being carried by the OBU so that the OBU of the current vehicle determines location of the vehicle.

In the embodiment, if the current vehicle is in the preset communication range, the first DSRC module corresponding to the communication range sends its location information to the second DSRC module corresponding to the current vehicle so as to determine location of the current vehicle.

Specifically, the location information is transmitted between the first DSRC module and the second DSRC module in the form of radio frequency signal.

In the embodiment, the solution of locating a vehicle by installing a vehicle locating device in some serious shielding areas of the CBD overcomes difficulty in locating a vehicle due to weak GPS signal or non-signal. Compared with the vehicle locating method by GPS in the prior art, the embodiment has the advantage of precise locating a vehicle in an area without signal or with weak signal.

Embodiment 3

The embodiment is also application oriented. In the embodiment, in a highway with major road and relief road in short distance, such as a distance less than 5 meters, while the GPS location precision is about 10 meters, the simple GPS location technology is unable to differ a major road from a relief road in the highway. If the vehicle locating device is installed on a relief road, that a second DSRC module included in an OBU carried by the current vehicle receives a radio frequency signal being sent by a first DSRC module contained in the installed vehicle locating device represents that the current vehicle is moving on a relief road; or else, it represents that the current vehicle is moving on a major road.

The embodiment is also used in a vehicle locating device. The device includes a controller and a first DSRC module in which the controller includes a determining module and a judging module.

As shown in Figure 3, a flow chart of a method for locating a vehicle is provided in Embodiment 3. The embodiment includes following steps.

Step 301, the determining module determines location information of the vehicle locating device

installed on a relief road of a highway.
In the embodiment, it is difficult to locate a vehicle with GPS location technology in the prior art because of a short distance between the major road and the relief road.
In practice, the vehicle locating device is pre-installed on relief road of a highway and a location flag of the vehicle locating device is determined as its location information. Specifically, the location flag is in a form of radio frequency signal.
In practice, because communication range being preset by the first DSRC module included by the vehicle locating device makes the vehicle locating device only communicate with a vehicle moving on the relief road, that the current vehicle receives a location flag in a form of radio frequency signal, sent by the vehicle location signal shows that the current vehicle is moving on the relief road.

Step 302, a communication range of the first DSRC module is set by adjusting transmitting power of the first DSRC module.

Step 303, the judging module judges whether the current vehicle installing OBU is in the communication range, and if yes, step 304 is executed.
What is described in steps 302-303 is the same as that in steps 202-203 and therefore details of it are omitted herein.

Step 304, the first DSRC module sends the location information to a second DSRC module carried by the OBU so that the OBU of the current vehicle determines location of the vehicle.

In the embodiment, in case that the current vehicle is in the preset communication range, the first DSRC module contained in the vehicle locating device which is pre-installed on a relief road sends location information of the vehicle locating device to the second DSRC module contained in the current vehicle and the current vehicle determines that it is on the relief road with the location information.
Specifically, the location information is in the form of radio frequency signal sent by the first DSRC module and in case that the vehicle receives the radio frequency signal sent by the first DSRC module, it indicates that the vehicle is on a relief road.
The embodiment overcomes shortcoming of failed location on a major road or a relief road with GPS location technology by installing a plurality of vehicle locating devices on a relief road nearby the major road.

Embodiment 4
As shown in Figure 4, a structural diagram of a device of locating a vehicle is provided in embodiment 4. The embodiment includes a controller 401 and a first DSRC module 402 in which the controller 401 includes a determining module 4011 and a judging module 4012.
The determining module 4011 is for determining location information of the vehicle locating device.
As shown in Figure 5, one of structural diagrams of the determining module 4011, the determining module 4011 includes a receiving sub-module 501 for receiving location information

computed by a RTK device for the vehicle locating device and a first determining sub-module 502 for determining the received location information as location information of the vehicle locating device.

As shown in Figure 6, one of structural diagrams of the determining module 4011, the determining module includes a first obtaining sub-module 601 for obtaining longitude, latitude and course of the vehicle locating device and a second determining sub-module 602 for determining the longitude, latitude and the course as the location information of the vehicle locating device.

As shown in Figure7, one of structural diagrams of the determining module 4011, the determining module 4011 includes a second obtaining sub-module 701 for obtaining a location flag of the vehicle locating device and a third determining sub-module 702 for determining the location flag as the location information of the vehicle locating device.

The judging module 4012 is for judging whether the current vehicle installing the OBU is in communication range being preset by the first DSRC module.

The first DSRC module 402 is for sending the location information to a second DSRC module carried by the OBU so that the OBU of the current vehicle determines the location of the current vehicle.

As shown in Figure 8, a structural diagram of the vehicle locating device, the device in Figure 4 is included in it. The controller 401 in Figure 8 further includes an adjusting module for adjusting communication range of the first DSRC module by adjusting transmitting power of the first DSRC module.

Embodiment 5

A vehicle locating system is provided, which includes a vehicle locating device and an OBU containing a second DSRC module. The vehicle locating device is any device shown in Figures 4-8 and the OBU is installed on the vehicle.

In the embodiment, the vehicle locating device is installed on both sides of a road with weak GPS signal and the OBU containing the second DSRC module is installed on the vehicle to be located. A communication range of the first DSRC module in the vehicle locating device is preset and in case that the current vehicle moves in the communication range, the first DSRC module sends location information of the vehicle locating device to the second DSRC module in the form of radio frequency signal, while in case that the second DSRC module receives the location information of the vehicle locating device, the vehicle is located according to the location information.

The embodiment is applied in a vehicle locating device. The device includes a controller and a first DSRC module in which the controller includes a determining module and a judging module. The embodiment includes that the determining module determines location information of the vehicle locating device; the judging module judges whether the current vehicle installing an OBU is in a communication range being preset by the first DSRC module, and if yes, the first DSRC module sends the location information to a second DSRC module carried by the OBU so that the OBU of the current vehicle determines location of the vehicle. Compared with the GPS vehicle locating method in the prior art, the embodiment has an advantage of precise location of the current vehicle. Compared with the vehicle locating method by dead reckoning in the prior art, the embodiment has an advantage of precise location of the current vehicle and correction of

errors from vehicle locating method by dead reckoning. In sum, compared with the prior art, the embodiment precisely locates a vehicle.

Because the device embodiment is basically corresponding to the method embodiment, the counterpart of the device embodiment can be obtained from description of the method embodiment. The above described device embodiments are only illustrative, in which the unit described as separate components may be or not separated physically and the part displayed as a unit can be or not a physical unit which can be located in one position or distributed over more networking units. Part or the whole modules can be selected as required to realize purpose of the embodiments and a common technician in the prior art should understand and implement it without involving any inventive effort.

It is noted that, in the application, terms such as first, second and the like are only used to differ an entity or operation from another entity and operation, not a requirement or indication of any practical relation or order among these entities or operations. Moreover, terms “include” and “contain” or other variations are intended to cover non-exclusive inclusion which make a process, method, product or device include a plurality of factors, not only those mentioned factors, but also other factors not being listed directly or factors inherent with the process, method, product or device. In case of less limits, the factor limited by a sentence “including a….” is not exclusive to other same factor in the process, method, product and device.

The above-mentioned is a detailed description of the method and device of locating a vehicle provided by the embodiments of the invention. Special examples are applied for clarifying the principle and embodiments of the invention. The description of the above embodiments is only for helping understand method and key ideas of the invention and an ordinary technical in the art may make changes in terms of the embodiments and scope of the application in accordance with ideas of the invention.

Claims

1. A method for locating a vehicle, which is applied in a vehicle locating device comprising a controller and a first DSRC module wherein the controller comprises a determining module and a judging module, comprising steps:

the determining module determines location information of the vehicle locating device;

the judging module judges whether a current vehicle installing an OBU is in a communication range being preset by the first DSRC module and if yes, the first DSRC module sends the location information to a second DSRC module being carried by the OBU so for the OBU of the current vehicle to determine a location of the current vehicle;

an adjusting module adjusts the communication range of the first DSRC module by adjusting transmitting power of the first DSRC module;

the vehicle locating device is installed on the major road or the relief road;

the location information includes a location flag of the installed vehicle locating device, the location flag is used to flag the vehicle driving on the major road or the relief road.

2. The method of claim 1, wherein the step that the determining module determines location information of the vehicle locating device comprises:

the determining module receives location information computed by a RTK device for the vehicle locating device; and

the determining module determines the received location information as the location information of the vehicle locating device.

3. The method of claim 1, wherein the step that the determining module determines location information of the vehicle locating device comprises:

the determining module obtains longitude, latitude and course of the vehicle locating device; and

the determining module determines the longitude, latitude and course as the location information of the vehicle locating device.

4. The method of claim 1, wherein the step that the determining module determines location information of the vehicle locating device comprises:

that the determining module obtains a location flag of the vehicle locating device; and

the determining module determines the location flag as the location information of the vehicle locating device.

5. A vehicle locating device comprising a controller and a first DSRC module in which the controller comprises a determining module and a judging module and specifically

the determining module is for determining location information of a vehicle;

the judging module is for judging whether a current vehicle installing an OBU is in a communication range being preset by the first DSRC module; and

the first DSRC module is for sending the location information to a second DSRC module carried by the OBU for the OBU of the current vehicle to determine its location; wherein

the vehicle locating device further comprises an adjusting module for adjusting the

communication range of the first DSRC module by adjusting transmitting power of the first DSRC module;

the vehicle locating device is arranged for installation on a major road or a relief road; and

the location information includes a location flag of the installed vehicle locating device, the location flag being for flagging the vehicle as driving on the major road or the relief road.

6. The device of claim 5, wherein the determining module comprises a receiving sub-module for receiving location information being computed by a RTK device for the vehicle locating device and a first determining sub-module for determining the received location information as the location information of the vehicle locating device.

7. The device of claim 5, wherein the determining module comprises a first obtaining sub-module for obtaining longitude, latitude and course of the vehicle locating device and a second determining sub-module for determining the longitude, latitude and course as the location information of the vehicle locating device.

8. The device of claim 5, wherein the determining module comprises a second obtaining sub-module for obtaining a location flag of the vehicle locating device and a third determining sub-module for determining the location flag as the location information of the vehicle locating device.

9. A system of locating a vehicle, comprising a vehicle locating device and an OBU which comprises a second DSRC module, in which the vehicle locating device is a device according to any one of claims 5-8 and the OBU is arranged for installation on the vehicle.