

COMPOSITE VEHICLE TRACKER FOR USE WITH ELECTRONIC TOLL COLLECTION SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the invention

5 This invention relates to a composite vehicle tracker for use with an electronic toll collection system, and in particular, to a composite vehicle tracker for use with an electronic toll collection system integrated with a global positioning system (GPS), a mobile communication system and a beacon communication module.

10 2. DESCRIPTION OF THE PRIOR ART

 A conventional manual toll collection system usually results in traffic jam and air pollution because the new-built roads are too finite to withstand the progressively increased vehicles. Particularly, for a purpose of minimizing the traffic jam, on successive holidays, the roadway operators have no choice but to stop the toll collection system in the highways. It is important to make full use of the limited roadway by employing a vehicular management system of today's intelligent traffic network. Although some electrical toll collection systems were developed, 15 they still had many drawbacks. For example, the construction cost of roadways, social cost correlating to reconstruction of roadways, cost of vehicle trackers are very critical to develop successful electronic toll collection systems.

 In today's vehicular toll collection system, after the drivers

have stopped their vehicles and paid fees, the vehicles are allowed to leave. Such toll collection system is not cost-effective. In addition, the procedures of stopping vehicles to pay fees are time-consuming and usually result in traffic jam. As for an automatic vehicular toll collection system in Taiwan, it is still under research and development. One automatic vehicular toll collection system in its trial period was practiced by throwing in coins. Such automatic system has failed due to several reasons.

Accordingly, the above-described prior art product is not a perfect design and has still many disadvantages to be solved.

In views of the above-described disadvantages resulted from the conventional open-type electronic toll collection system, the applicant keeps on vehicleing unflaggingly to develop a composite vehicle tracker for use with an open-type electronic toll collection system according to the present invention through wholehearted experience and research.

SUMMARY OF THE INVENTION

An object of the invention is to provide a composite vehicle tracker for use with an open-type electronic toll collection system, which integrates existing global positioning system (GPS), mobile communication system and beacon communication module to universally apply to an electronic toll collection system, such that costs of the manual toll collection system, construction cost of operating equipments, loading of vehicle trackers, passing time of the vehicles, energy source and air pollution are reduced, and this

electronic toll collection system facilitates quick and convenient passage of vehicles.

Another object of the invention is to provide a composite vehicle tracker for use with an open-type electronic toll collection system, which uses a beacon communication module to reinforce communication in dead space so as to electronically and automatically deduct money from marching vehicles.

The above objects of the present invention can be achieved by using a composite vehicle tracker for use with an open-type electronic toll collection system. The composite vehicle tracker comprises a central processing module, a global positioning module, a mobile communication module, a beacon communication module, an IC interface module and an information output module, wherein the central processing module is a main control center for receiving data correlating locations and time positioned by the global positioning module, controlling the IC interface module to deduct money from an IC card electronic wallet, and transmitting the data into a rear-end accounting system for audit via the mobile communication module and the beacon communication module; the global positioning module continuously receives data from a satellite via an antenna, the data are then converted into readable data correlating locations and time so as to be transferred to the central processing module; the mobile communication module is used as a communicative interface between the vehicle tracker and a base station, for noticing the data correlating locations and time of the vehicle tracker and deducted money from the electronic wallet to the accounting center via the base station, and receiving return

data from the accounting center; the beacon communication module is used to reinforce universal communication of the vehicle tracker when poor communicative strength of the global positioning module and the mobile communication module exists, thus, the data correlating locations and time of the vehicle tracker and deducted money from the electronic wallet can be noticed to the accounting center via the beacon communication module, and the return data from the accounting center will be received.

BRIEF DESCRIPTION OF THE DRAWINGS

10 The drawings disclose an illustrative embodiment of the present invention which serves to exemplify the various advantages and objects hereof, and are as follows:

Fig. 1 is a block diagram of a composite vehicle tracker for use with an open-type electronic toll collection system according to
15 the present invention;

Fig. 2 is a schematic diagram illustrating a traffic communication system by using a composite vehicle tracker for use with an open-type electronic toll collection system;

Fig. 3 is a flowchart illustrating an enforcement system by
20 using a composite vehicle tracker for use with an open-type electronic toll collection system;

Fig. 4 is a flowchart illustrating an electronic toll collection system by using a composite vehicle tracker for use with an open-type electronic toll collection system; and

25 Fig. 5 is a flowchart illustrating an accounting audit system by

using a composite vehicle tracker for use with an open-type electronic toll collection system.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

5 Referring to Figs. 1 and 2, a composite vehicle tracker for use with an open-type electronic toll collection system according to the present invention principally comprises:

 a central processing module 1 used as a main control center, wherein the central processing module 1 receives data correlating
10 locations and time positioned by a global positioning module 2 and compares the data received thereby with those of a predetermined site, when the comparing result is coincident, an IC interface module 6 is controlled to deduct money from an IC card electronic wallet, and the data are transmitted into an accounting center for
15 audit via a mobile communication module 3 and a beacon communication module 4 so as to obtain automatic pay of vehicular fees;

 a global positioning module 2, wherein the global positioning module 2 continuously receives data from a satellite 9 via an
20 antenna 21, the data are then converted into readable data correlating locations and time so as to be transferred to the central processing module;

 a mobile communication module 3, wherein the mobile communication module can utilize honeycomb or micro-cell
25 honeycomb mobile data communication, and is a communicative

interface between the vehicle tracker and a base station 7, for noticing the data correlating locations and time of the vehicle tracker and deducted money from the electronic wallet to the accounting center 8 via the base station 7, and receiving return data
5 from the accounting center 8;

a beacon communication module 4, wherein the beacon communication module 4 is microwave or infrared medium for short-distance communication, when the communicative strength of the global positioning module 2 and the mobile communication
10 module 3 is less than a threshold value, the central processing module 1 awakes the beacon communication module 4 ready for communication, thereby reinforcing communication in dead space so as to obtain universal communication, furthermore, the data correlating locations and time of the vehicle tracker and deducted
15 money from the electronic wallet can be noticed to the accounting center 8 via the beacon communication module 4, and the return data from the accounting center 8 will be received;

an IC interface module 6, wherein the IC interface module 6 is used to deduct tolls from an IC car electronic wallet of a driver; and

20 an information output module 5, wherein the information output module 5 is used to output characters, images and sounds by means of a display or a buzzer, for example.

Please refer to Figs. 3 to 5, which are flowcharts illustrating operations of a composite vehicle tracker for use with an open-type
25 electronic toll collection system. Firstly, a vehicle tracker of the present invention is carried on a vehicle. When the vehicle drives on a toll section of a highway or other sections of roads requiring

collecting fees, the vehicle tracker will effect an enforcement system by automatically identifying the type and the vehicle identification number of the vehicle. In the flowchart of Fig. 3, an image processing system (101) of the vehicle tracker will capture an image of the license plate the vehicle (102), and then an identifying operation is performed on the license plate (103). Afterward, the data correlating to the result of the identifying operation is transmitted to an accounting center (104). The satellite positioning receiver on the vehicle tracker will record all traveling lines of the vehicle, and compare these traveling lines with traveling lines of predetermined toll collection points (for example toll collection stations). In the flowchart of Fig. 4, the vehicle tracker 201 can determine whether the vehicle enters the toll collection site (202). If the vehicle enters the toll collection site, the vehicle tracker will be in communication with the accounting center to perform a toll-paid operation (203), and the electronic toll collection system will continuously monitor whether other vehicles enter the toll collection site (202) or otherwise end the operations (204). If not, the electronic toll collection system will continuously monitor whether other vehicles enter the toll collection site (202).

The above tolls can be directly deducted from an IC card electronic wallet by means of the IC card interface. Furthermore, prepayment, payment by credit or payment by pre-stored usernames is also effective. By automatically noticing the accounting center via the communication system, capturing the image of the license plate the vehicle via the enforcement system located on toll

collection sites, and identifying the license plate via the automatic identification system, the accounting center will confirm the type, the vehicle identification number, the speed of the vehicle, the passing time spot of the vehicle, the deducting information, the audit procedure, etc. In the flowchart of Fig. 5, the accounting center (301) will check the information correlating to the vehicle and its deducting condition (302), and determine whether the vehicle has paid fees (303). If the fees have been paid, the vehicle is allowed to leave and the image of its license plate is deleted (304). If not, according to the captured image of the license plate, the owner of the vehicle can be found and fined in accordance with the law (305).

The composite vehicle tracker for use with an open-type electronic toll collection system according to the present invention, when comparing with other previous conventional technologies, has following advantages:

1. The present invention relates to a fully automatic electronic toll collection system, in characterized in that the vehicle needs not stop to pay fees, such that the driving time is saved, the traffic jam is reduced and the air pollution is minimized.

2. The present invention utilizes the commercially available global positioning system (GPS) module and mobile communication module to reduce cost of the vehicle tracker due to large reduction of the components thereof, such that the vehicle of excellent quality and reasonable price encourages the driver to install such vehicle tracker and facilitates optimizing functions of the vehicle management system.

3. The vehicle tracker of the present invention facilitates reinforcing communication in dead space by means of the beacon communication module such that most sections of roadway needs not to be equipped with additional construction and thus the construction and operating costs and the buildup time are largely
5 reduced. In such manner, the operating costs of the roadway operators are reduced and shifted to the vehicle trackers of the drivers.

Many changes and modifications in the above described
10 embodiment of the invention can, of course, be carried out without departing from the scope thereof. Accordingly, to promote the progress in science and the useful arts, the invention is disclosed and is intended to be limited only by the scope of the appended claims.

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What is claimed is:

1. A composite vehicle tracker for use with an open-type electronic toll collection system, comprising essentially of a central processing module, a global positioning module, a mobile communication module, a beacon communication module, an IC interface module and an information output module, wherein said central processing module receives data correlating locations and time positioned by said global positioning module and compares said data received thereby with those of a predetermined site, when the comparing result is coincident, said IC interface module is controlled to deduct money from an IC card electronic wallet, and said data are transmitted into an accounting system for audit via said mobile communication module and said beacon communication module so as to obtain automatic pay of vehicular fees.
2. The composite vehicle tracker for use with an open-type electronic toll collection system according to claim 1, wherein said global positioning module continuously receives data from a satellite via an antenna, said data are converted into readable data correlating locations and time so as to be transferred to said central processing module.
3. The composite vehicle tracker for use with an open-type electronic toll collection system according to claim 1, wherein said beacon communication module is microwave or infrared medium for short-distance communication, wherein when the communicative strength of said global positioning module and said mobile

communication module is less than a threshold value, said central processing module awakes said beacon communication module ready for communication, thereby reinforcing communication in dead space so as to obtain universal communication.

5 4. The composite vehicle tracker for use with an open-type electronic toll collection system according to claim 1, wherein said mobile communication module is a communicative interface between said vehicle tracker and a base station, for noticing the data correlating locations and time of said vehicle tracker and
10 deducted money from said electronic wallet to an accounting center via a base station, and receiving return data from said accounting center.

5. The composite vehicle tracker for use with an open-type electronic toll collection system according to claim 1, wherein said
15 IC interface module deducts tolls from an IC card electronic wallet of a driver.

6. The composite vehicle tracker for use with an open-type electronic toll collection system according to claim 1, wherein said information output module allows vehicle tracker to provide
20 information associated to roadway and money deduction.

7. The composite vehicle tracker for use with an open-type electronic toll collection system according to claim 1, wherein said mobile communication module uses honeycomb mobile data communication.

8. The composite vehicle tracker for use with an open-type electronic toll collection system according to claim 6, wherein said information output module outputs characters, images and sounds by means of a display or a buzzer.

5 9. The composite vehicle tracker for use with an open-type electronic toll collection system according to claim 7, wherein said mobile communication module uses micro-cell honeycomb mobile data communication.

10 10. The composite vehicle tracker for use with an open-type electronic toll collection system according to claims 7 and 9, wherein when the communicative strength of said global positioning module is less than a threshold value, said central processing module enables cell codes or micro-cell codes of said mobile communication module to position.

15 11. A composite vehicle tracker for use with an open-type electronic toll collection system, comprising essentially of a central processing module, a global positioning module, a mobile communication module, an IC interface module and an information output module, wherein said central processing module receives
20 data correlating locations and time positioned by said global positioning module and compares said data received thereby with those of a predetermined site, when the comparing result is coincident, said IC interface module is controlled to deduct money from an IC card electronic wallet, and said data are transmitted into
25 an accounting system for audit via said mobile communication module and said beacon communication module so as to obtain

automatic pay of vehicular fees.

12. The composite vehicle tracker for use with an open-type electronic toll collection system according to claim 11, wherein said global positioning module continuously receives data from a satellite via an antenna, said data are converted into readable data correlating locations and time so as to be transferred to said central processing module.

13. The composite vehicle tracker for use with an open-type electronic toll collection system according to claim 11, wherein said mobile communication module is a communicative interface between said vehicle tracker and a base station, for noticing the data correlating locations and time of said vehicle tracker and deducted money from said electronic wallet to an accounting center via a base station, and receiving return data from said accounting center.

14. The composite vehicle tracker for use with an open-type electronic toll collection system according to claim 11, wherein said IC interface module deducts tolls from an IC card electronic wallet of a driver.

15. The composite vehicle tracker for use with an open-type electronic toll collection system according to claim 11, wherein said information output module allows vehicle tracker to provide information associated to roadway and money deduction.

16. The composite vehicle tracker for use with an open-type

electronic toll collection system according to claim 1, wherein said mobile communication module uses honeycomb mobile data communication.

17. The composite vehicle tracker for use with an open-type
5 electronic toll collection system according to claim 15, wherein said information output module outputs characters, images and sounds by means of a display or a buzzer.

18. The composite vehicle tracker for use with an open-type
10 electronic toll collection system according to claim 16, wherein said mobile communication module uses micro-cell honeycomb mobile data communication.

19. The composite vehicle tracker for use with an open-type
electronic toll collection system according to claims 16 and 18,
wherein when the communicative strength of said global positioning
15 module is less than a threshold value, said central processing module enables cell codes or micro-cell codes of said mobile communication module to position.