DESCRIPTION

VEHICLE MANAGEMENT CENTER

TECHNICAL FIELD

The present invention relates to a vehicle management center which from time to time obtains various kinds of vehicle-status information respectively indicating various statuses of a vehicle, to an information providing method used by the center, and to a travel distance calculating method used by the center.

BACKGROUND ART

A vehicle management system has hitherto been known, in which from time to time various kinds of vehicle-status information respectively indicating various statuses of a vehicle are sent from the vehicle to a vehicle management center. Upon receipt of such information, the vehicle management center determines whether a part or the like should be replaced and informs the vehicle of the result of the determination. Such a system is exemplified by Japanese Patent Application Laid-Open (*kokai*) No. 2002-183284 in which, each time the engine is started, various kinds of information indicating the travel distance, the remaining amount of each brake pad, the date/time of the last oil change, the date/time of the last replacement of a light bulb, and other statuses are sent from the vehicle to the vehicle management center, whereupon the vehicle management center determines whether the oil, brake pad, light bulb or the like should be replaced and informs the vehicle of the result of the determination.

However, in the above-described conventional system, since information concerning the vehicle is provided on the basis of information indicating the present status of the vehicle, there is a problem that the information can be neither provided nor prepared early enough. Further, in the conventional apparatus, since the information concerning oil change or the like is provided on the basis of only the travel distance obtained from the vehicle, accurate information cannot be provided in some cases; for example, in a case where a measured value of the travel distance of the vehicle is changed, reset, or cleared, intentionally or by error.

DISCLOSURE OF THE INVENTION

A first invention is made in order to cope with the former problem, and an object of the first invention is to provide a vehicle management center that can provide and prepare information early enough, and an information providing method used by the center. A second invention is made in order to cope with the latter problem, and an object of the second invention is to provide a vehicle management center that can provide correct information to a vehicle despite a measured value of the travel distance of the vehicle being changed, reset, or cleared, and a travel distance calculating method used by the center.

In order to attain the object, the first invention comprises: obtaining means for obtaining from time to time vehicle-status information representing a status of a vehicle; storing means for storing the vehicle-status information up to the present time obtained from time to time by the obtaining means or vehicle-status information up to the present time which represents the statue of the vehicle and which is formed on the basis

of the vehicle-status information obtained from time to time by the obtaining means; estimating means for estimating a future status of the vehicle from the vehicle-status information up to the present time stored in the storing means; and information providing means for providing information to the outside according to the estimated future status of the vehicle.

Preferably, for example, the information providing means may include mail creating and storing means for creating a mail containing information to be sent to the outside in accordance with the future status of the vehicle, which status is estimated by the estimating means, and for storing the created mail with timing information attached thereto, the timing information indicating a timing at which the mail is to be sent; and sending means for sending the mail stored in the mail creating and storing means to the outside at the timing indicated by the timing information.

According to the first invention constructed as above, because a future status of the vehicle is estimated from the vehicle-status information up to the present time, information can be provided early enough, or preparations for provision of the information can be made early enough. Particularly, if a mail is created in advance as mentioned above, appropriate season's greetings at the beginning of the mail can be selected, or event or service information can be contained in the mail in accordance with the schedule of various events or services concerning the vehicle. Further, if the status of the vehicle is a travel distance of the vehicle, it is possible to inform the vehicle of the correct timing of oil change.

Further, the status of the vehicle may be, as an alternative of the above-mentioned travel distance of the vehicle, a status of a quantity in relation to the vehicle such as the remaining amount of a brake pad. The

vehicle status, such as the travel distance and the brake pad status, varies with time, and the manner of change of the status differs between users. Such a vehicle status is not information that can be easily grasped by a management center as can a regular inspection such as a one-month-use inspection or a six-month-use inspection. However, if a future status of the vehicle is estimated from the vehicle-status information obtained from time to time according to the present invention described above, it is possible to grasp the vehicle status in advance at the management center so that the management center can prepare and provide the information early enough.

In order to attain the object, the second invention comprises: obtaining means for obtaining travel distance information measured at the vehicle and indicating a travel distance of the vehicle; obtained information storing means for storing at least previous travel distance information obtained by the obtaining means; and travel distance calculating means for calculating a travel distance of the vehicle up to the present by successively cumulating an increase in distance from a previous travel distance to a present travel distance, the previous travel distance being represented by the previous travel distance information stored in the obtained information storing means, the present travel distance being represented by the travel distance information obtained by the obtaining means for the present time.

In the second invention constructed as above, a travel distance of the vehicle is calculated by successively cumulating an increase of the present travel distance obtained from the vehicle at the present time, from the previous travel distance obtained from the vehicle at the previous time. Accordingly, even if a measured value of travel distance of the vehicle is changed, reset, or cleared, intentionally or by error, the calculation of travel

distance since then is not influenced by such changing, resetting, or clearing, so that the travel distance of the vehicle can be calculated in a virtually accurate manner. As a result, exact information (e.g. time to change oil) relating to the travel distance of a vehicle can be provided all the time, and a correct travel distance can be provided regardless of the changing, resetting, or clearing.

Further, these inventions may be defined as an information providing method used by a vehicle management center and a travel distance calculating method used by a vehicle management center.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic diagram showing the overall configuration of a vehicle management system according to an embodiment of the present invention.

FIG. 2 is a schematic block diagram showing an on-vehicle terminal apparatus of FIG. 1.

FIG. 3 is a schematic diagram showing a vehicle management center of FIG. 1.

FIG. 4 is a flowchart showing a vehicle-status information sending program to be executed at the on-vehicle terminal apparatus, and a vehicle-status information receiving program to be executed at the vehicle management center.

FIG. 5 is a flowchart showing a mail sending program to be executed at the vehicle management center.

FIG. 6 is a graph showing the manner of variation of cumulated travel distance.

BEST MODE FOR CARRYING OUT THE INVENTION

An embodiment of the present invention will now be described with reference to the drawings. FIG. 1 is a schematic diagram showing a vehicle management center according to the embodiment. The vehicle management system comprises a plurality of on-vehicle terminal apparatus 10, at least one vehicle management center 20, a plurality of personal computers 30, a plurality of portable personal data terminal apparatuses 40, a plurality of cellular phones 50, and computers 60a, 60b, 60c located at a vehicle insurance company, a vehicle rental/leasing company, a vehicle dealer, etc.

The individual on-vehicle terminal apparatus 10 is carried on a vehicle and is constructed so as to be able to communicate, by radio, with a relay station 80 and the vehicle management center 20, which is connected to a network 70 (e.g. the Internet). The vehicle management center 20 is connected to the network 70 and is constructed so as to be able to communicate with the on-vehicle terminal apparatuses 10 and the relay station 80 by radio. Each personal computer 30 is located at a user's (vehicle owner's) home or office and is connected to the network 70.

The portable personal data terminal apparatuses 40 are carried by the individual users and are connectable to the network 70. Each portable personal data terminal apparatus 40 may be connected to the network 70 via the respective personal computer 30 or may be communicable with the relay station 80 by radio. The cellular phones 50 are constructed as to be able to communicate with the relay station 80. The computers 60a, 60b, 60c are connected to the network 70.

The on-vehicle terminal apparatus 10 is located near the driver's seat in the passenger compartment and includes an input unit 11, a display unit 12, a data processing unit 13, a storage unit 14, and a communication unit 15, which are electrically interconnected, as shown in FIG. 2. The input unit 11 is in the form of an operation switch mounted near the display unit 12, or a panel touch switch built in the display unit 12 to detect touch operations on a display panel or the like, thereby inputting directions of the driver. The display unit 12 is in the form of a liquid crystal display unit or the like, which displays letters, graphics, a map, etc. on a display panel to visually inform the driver of various kinds of information.

The data processing unit 13 includes a CPU, a ROM, a RAM, etc., which control operations of the display unit 12, the storage unit 14, and the communication unit 15 under the driver's directions or automatically, upon execution of a program; in the present embodiment, a vehicle-status information sending program shown in FIG. 4 in particular is executed. The storage unit 14 includes a recording medium such as a hard disc, a CD-ROM, a DVD-ROM, and a drive unit for the recording medium. The storage unit 14 stores various programs, various kinds of data, etc. In the present embodiment, the storage unit 14 stores the vehicle-status information sending program shown in FIG. 4 in particular. The communication unit 15 is communicable with the vehicle management center 20 and the relay station 80 by radio. An antenna 15a is connected to the communication unit 15 for wireless communication with the relay station 80 or the vehicle management center 20.

In addition, to the data processing unit 13, a travel distance detection unit 16 also is connected. The travel distance detection unit 16

includes a pulse-generating circuit for generating pulse signals one at each time when an output shaft of a power transmission unit turns by a predetermined angle, and a counter for counting the generated pulses and storing the result of the counting as a count value. Then, the count value of the counter is provided to the data processing unit 13 as a detected travel distance.

The vehicle management center 20 comprises a data processing unit 21, a storage unit 22, and a communication unit 23, which are electrically interconnected, as shown in FIG. 3. The data processing unit 21 includes a CPU, a ROM, and a RAM and has the same construction as the data processing unit 13 of the on-vehicle terminal apparatus 10. The storage unit 22 includes a recording medium such as a hard disc, a CD-ROM, a DVD-ROM, and a drive unit for the recording medium. The storage unit 22 stores various programs and various kinds of data. Particularly, in the present embodiment, the storage unit 22 stores the vehicle-status information receiving program of FIG. 4 and a mail sending program of FIG. 5, and has a received travel distance storage area 22a, a cumulated travel distance storage area 22b, and a sending mail storage area 22c.

The received travel distance storage area 22a stores and reserves detected travel distances Lc received from the on-vehicle terminal apparatus 10 successively up to the present time for each user (vehicle), as received travel distances Lc(1), Lc(2)...Lc(n). The cumulated travel distance storage area 22b stores and reserves cumulated travel distances La calculated by the data processing unit 21 successively up to the present time for each user (vehicle), as cumulated travel distances La(1), La(2)...La(n). The

sending mail storage area 22c stores and reserves unsent mails created by the data processing unit 21.

The communication unit 23 is connected to the network 70 by cable or wire and is communicable with the relay station 80, the on-vehicle terminal apparatus 10, etc. by radio. To the communication unit 23, an antenna 23a for wireless communication is connected.

The personal computer 30 also has substantially the same construction as the on-vehicle terminal apparatus 10, and is equipped with an input unit, a display unit, a data processing unit, and a storage unit, which are electrically interconnected. The personal computer 30 also may be additionally equipped with a wirelessly communicable communication unit. The portable personal data terminal apparatus 40 is also equipped with an input unit, a display unit, a data processing unit, and a storage unit, which are similar to those of the personal computer 30 and which are electrically interconnected. The portable personal data terminal apparatus 40 also may be additionally equipped with a wirelessly communicable communication unit, and may be connectable to the network 70 through the personal computer 30. Like the personal computer 30, the cellular phone 50 comprises an input unit, a display unit, a data processing unit, and a storage unit, which are electrically interconnected, and is additionally equipped with a wireless communicable communication unit.

Like the personal computer 30, each of the computers 60a, 60b, 60c comprises an input unit, a display unit, a data processing unit, and a storage unit, which are electrically interconnected. In the storage units of these computers 60a, 60b, 60c, various kinds of information concerning vehicle and users are stored as customer information, and information concerning

events, services, etc. is also stored. The information concerning events, services, etc. is sent to the vehicle management center 20 or the like at convenient times.

In the vehicle management system constructed in the manner described above, communication with respect to the on-vehicle terminal apparatus 10 and the cellular phone 50 takes place only wirelessly. Meanwhile, communication with respect to the vehicle management center 20, the personal computer 30, the portable personal data terminal apparatus 40, and the relay station 80 takes place wirelessly and through cable or wire. Either one of wireless communication and communication through cable or wire may be selected in consideration of convenience, speed, etc., and no characteristic feature resides in means of communication itself. Therefore, in the following description, terms referred to merely as communication, receiving, sending, etc. should be considered to mean communication using a suitable method.

The operation of the present embodiment constructed as described hereinabove will now be explained. Firstly, if a user buys or rents a vehicle, or takes a vehicle on lease and applies for an insurance policy on the vehicle, the user together with the vehicle is registered in the vehicle management center 20 as well as in the individual computers 60a, 60b, 60c of a vehicle insurance company, a vehicle rental/leasing company, and a vehicle dealer. For this user registration, vehicle identification data CID allotted to each vehicle and previously stored in the on-vehicle terminal apparatus 10, an on-vehicle terminal identification data TID allotted to the on-vehicle terminal apparatus 10, and other data are stored also in the storage unit 22 of the vehicle management center 20, and the respective

storage units of the computers 60a, 60b, 60c of the vehicle insurance company, the vehicle rental/leasing company, and the vehicle dealer.

Actual operation after this user registration will now be described. Each time a signal indicating that an engine has been started is input from a non-illustrated engine starting circuit, the data processing unit 21 of the on-vehicle terminal apparatus 10 executes the vehicle-status information sending program of FIG. 4, which program is stored in the storage unit 22. The execution of this vehicle-status information sending program is started at step C10, and in step C12 the data processing unit 13 obtains a detected travel distance Lc from the travel distance detection unit 16. This detected travel distance Lc is measured by the travel distance detection unit 16 while the vehicle is traveling and is stored as a cumulative value of travel distances of the vehicle up to the present time.

Then, in step C14, the data processing unit 13 sends the obtained detected travel distance Lc, together with the vehicle identification data CID, the on-vehicle terminal identification data TID, etc., to the vehicle management center 20 through the communication unit 15. Then, in step C16, the data processing unit 13 ends the execution of the vehicle-status information sending program. In this manner, each time the engine is started, the detected travel distance Lc indicating the travel distance of the vehicle at that time, the vehicle identification data CID, the on-vehicle terminal identification data TID, etc. are sent from the on-vehicle terminal apparatus 10 to the vehicle management center 20.

Meanwhile, in the vehicle management center 20, the communication unit 23 receives the detected travel distance Lc, the vehicle identification data CID, the on-vehicle identification data TID, which are sent

in the above-described manner. In response to this receiving, in step M10 in FIG. 4 the data processing unit 21 starts execution of the vehicle-status information receiving program to additionally store the detected travel distance Lc received in step M12 into the received travel distance storage area 22a in the storage unit 22, as the travel distance Lc(n) received at the present time. The received travel distance storage area 22a is divided into sub-areas that are provided, at the time of the above-mentioned user registration, one for each user to successively accumulate and store the detected travel distance Lc to correspond to the vehicle identification data CID. In this storage of the detected travel distance Lc, the individual detected travel distances Lc, together with the time of receipt, etc. are successively stored in the storage area corresponding to the vehicle identification data CID, the on-vehicle identification data TID, etc. The detected travel distance Lc stored at the present time is represented as the presently received travel distance Lc(n), and the detected travel distance Lc stored at the previous time is represented as the previously received travel distance Lc(n-1). This manner of representation is applied to a cumulated travel distance La to be described later.

After the processing of step M12, in step M14, the stored presently received travel distance Lc(a) and the previously received travel distance Lc(n-1) for the same vehicle are read from the sub-areas in the received travel distance storage area 22a, which sub-areas are prepared one for each user. Then, in step M16, an increase ΔL in distance from the previously received detected travel distance Lc to the presently received detected travel distance Lc is calculated by executing the arithmetic of the following equation (1).

$$\Delta L = Lc(n) - Lc(n-1) \qquad (1)$$

Subsequently, in step M18, determination is made as to whether the increase ΔL is equal to or larger than "0." The detected travel distance Lc is successively detected by the travel distance detection unit 16 of the vehicle, representing the travel distance from the start of traveling of the vehicle up to the present time. Therefore, this increase ΔL must be equal to or larger than "0" under normal conditions in which the detected travel distance Lc in the travel distance detection unit 16 is not changed, reset, or cleared. At this time, if the travel distance Lc detected by the travel distance detection unit 16 is normal, the result of the determination is "Yes" in step M18, so that a new cumulated travel distance La is calculated in step M20 by executing the arithmetic of the following equation (2) using the increase ΔL and the previous cumulated travel distance La(n-1). This previous cumulated travel distance La(n-1) is a value previously stored in the cumulated travel distance storage area 22b of the storage unit 22 by the processing of step M26 to be described later. Further, in the cumulated travel distance storage area 22b, an initial value is stored at the time of registration of the user as the cumulated travel distance La(0). As this initial value, "0" is adopted if the user is registered at the time of purchase of a new vehicle. If the user is registered at the time of purchase of a used vehicle, the travel distance Lc detected by the travel distance detection unit 16 at that time is adopted.

$$Lc = La(n-1) + \Delta L \qquad (2)$$

After the processing of step M20, in step M26, the cumulated travel distance La previously calculated is additionally stored in the cumulated travel distance storage area 22b as the present cumulated travel distance La(n). Then, in step M28, using the manner of variation of the past cumulated travel distance La(1), La(2)...La(n) of the vehicle, the data processing unit 21 predicts and estimates a future cumulated travel distance La for a predetermined period (e.g. one or two months) by means of prediction. The solid line in FIG. 6 indicates the cumulated travel distances La(1), La(2)...La(n) up to the present time; the data processing unit 21 estimates variation of a future cumulated travel distance La as indicated by a dash-and-two-dot line in accordance with the manner of variation of these cumulated travel distances La(1), La(2)...La(n). In this estimation, using the average of variation of cumulated travel distances La obtained every week over the past one or two months, the data processing unit 21 predicts a cumulated travel distance La of one or two months later by means of arithmetic.

After the processing of step M28, in step M30, the data processing unit 21 determines whether a condition for creating a mail to be sent to the user (vehicle) is established, on the basis of the estimation of the future cumulated travel distance La. This mail creating condition determines whether the cumulated travel distance La is predicted to reach a distance (e.g. every 3,000 km of travel distance) corresponding to a time to change oil within a forthcoming period (e.g. one or two months). In the case where the above-described condition is not established, the data processing unit 21 determines "No" in step M30, execution of the vehicle-status information

receiving program is ended in step M36.

Meanwhile, if the above-described condition is established, the data processing unit 21 determines "Yes" in step 30, and creates a mail in step M32. In this mail creation, a sentence informing the user (vehicle owner) that the time to change oil is coming in accordance with the cumulated travel distance La is created automatically. Then, in step M34, the created mail is stored into the sending mail storage area 22c provided in the storage unit 22, along with an address of the on-vehicle terminal apparatus 10 recorded at the time of user registration and a timing (e.g. date/time) to send the mail; and in step M36, the data processing unit 21 ends the execution of this vehicle-status information sending program. As to the timing to send the mail, it is preferable to send the mail at a date/time, for example, about one week earlier than the data/time to change oil, which date/time is calculated from the cumulated travel distance La.

At the same time, in step M32, there is created a mail informing the dealer that there is a customer who should change oil at that time. This mail is also stored in the sending mail storage area 22c along with an address of the computer 60c of the dealer, a date/time to send the mail (e.g. date/time about one or two weeks earlier than the forthcoming oil change).

Further, in determining the mail creating condition in step M30 and creating the mail in step M32, the period to hold various events (e.g. introduction of a new model car) concerning the vehicles of a vehicle dealer, various services (discounting car parts, car inspection, etc.), etc. may be taken into consideration. Namely, if various events or various services appear to take place in forthcoming days during the estimated period for oil change, the periods of various events and various services may also be

regarded as the mail creating condition in the determination in step M30. Further, in creating the mail in step M32, it is preferable that contents giving notice various events or services are contained in the mail. In that case, it is preferable that, when the created mail is stored in the sending mail storage area 22c in step M34, a data/time a predetermined period before various events or services is attached as the date/time to send. It is also preferable that the information concerning these various events and services is uploaded from the computer 60c of the dealer to the vehicle management center 20 at a convenient time.

Further, in step M50, the data processing unit 21 of the vehicle management center 20 starts execution of a mail sending program of FIG. 5 at every predetermined period (e.g. every one day). After this starting, in step M52, the data processing unit 21 checks the data/time attached to each mail in the sending mail storage area 22c of the storage unit 22, thereby checking whether any mail to be sent exists. During execution of the mail sending program, if a mail to be sent exists, the data processing unit 21 determines "Yes" in step M54; namely, determines that a mail to be sent exists, and in step M56 sends all such mails through the communication unit 23. In this sending, using addresses attached to the mails, the data processing unit 21 sends the mails to the on-vehicle terminal apparatus 10 and the computer 60c of the dealer. The mails having been sent are erased from the sending mail area 22, and then execution of the data processing program is ended in step M58. On the other hand, if the result of determination in step M54 is "No"; namely, it is determined that no mail to be sent exists, the mail sending processing of step M56 is not executed as a matter of course, so that execution of this mail sending program is ended in

step M58.

In the manner described above, the mails sent from the vehicle management center 20 are received by the on-vehicle terminal apparatus 10 and the computer 60c of the dealer under the execution of a non-illustrated program. By these received mails, the user (vehicle owner) can know that the period to change oil in his or her vehicle is approaching. Meanwhile, a salesperson of the dealer can know of the existence of the vehicle whose period to change oil is approaching.

In the mail sending processing in step M56, such mails are sent to only the on-vehicle terminal apparatus 10 and the computer 60c of the dealer. However, a personal computer 30, a portable personal data terminal apparatus 40, or the like may be registered in the vehicle management center 20. In this case, the vehicle management center 20 can send, in step M56, a mail of the same contents as that sent to the on-vehicle terminal apparatus 10, to the personal computer 30, the portable personal data terminal apparatus 40 or the like.

Further, the computer 60a of the insurance company and the computer 60b of the rental/leasing company may be registered in the vehicle management center 20. In this case, the vehicle management center 20 can send the cumulated travel distance La to the computers 60b, 60c at every predetermined period according to the processing of steps M30 - M34 and M56. In this case, the insurance company and the rental/leasing company also can grasp travel distance of vehicle and hence can obtain effective information automatically if the contents of a contract contain a term of condition concerning the travel distance of the vehicle.

As is understood from the foregoing description, in the present

embodiment, a forthcoming travel distance is estimated from the travel distances up to the present time, and a mail indicating a timing of oil change is sent to the on-vehicle terminal apparatus 10, the computer 60c of the vehicle dealer, etc. in accordance with the estimated prospective travel distance. Therefore, the vehicle management center 20 can provide information about the time for oil change to a user (vehicle owner), the vehicle dealer, etc. early enough. Further, the vehicle management center 20 can prepare a mail giving notice of the time for oil change early enough. In this case, it is possible to select appropriate season's greetings of a mail and to send the mail with information concerning various events and services regarding the vehicle being contained in the mail, in accordance with the periods of such events and services.

Further, in the foregoing description, it is explained the case in which the detected travel distance Lc in the travel distance detection unit 16 assumes a normal status free of being changed, reset, or cleared. Then, there will now be explained a case in which the detected travel distance Lc is not kept normal. If the detected travel distance Lc in the travel distance detection unit 16 is changed, reset, or cleared intentionally or by error, the detected travel distance Lc having been sent from the vehicle terminal apparatus 10 to the vehicle management center 20 at the present time becomes smaller than the previously sent detected travel distance Lc. As a result, an increase ΔL calculated from the above-described equation (1) at the above-mentioned step M16 becomes smaller than "0." Consequently, the data processing unit 21 determines "No," and processing proceeds to step M22.

In step M22, the data processing unit 21 sends a message informing

that the received detected travel distance Lc is abnormal, to the computer 60a of the insurance company, the computer 60b of the rental/leasing company, and the computer 60c of the dealer through the communication unit 23. These computers 60a - 60c receive such sent information under the execution of a non-illustrated program. As a result, the insurance company, the rental/leasing company, and the dealer can notice that the detected travel distance Lc in the travel distance detection unit 16 has been changed, reset, or cleared intentionally or by error, and hence can cope with that fact quickly and precisely.

Further, after the processing of step M22, in step M24, the cumulated travel distance Lc is set to the previous cumulated travel distance La(n-1). Then, by the processing of step M26 described above, this cumulated travel distance La is additionally stored in the cumulated travel distance storage area 22b of the storage unit 22 as the present cumulated travel distance La(n). Subsequently, when the vehicle-status information sending program is executed, in the same manner as in the above-mentioned case, an increase ΔL from the previously received detected travel distance Lc(n-1) to the presently received detected travel distance Lc(n) is calculated by the processing of M16, and the calculated increase ΔL is added to the previous cumulated travel distance La(n-1) by the processing of step M20. As a result, a new cumulated travel distance La (corresponding to the present cumulated travel distance La(n)) is calculated.

This calculation will now be explained in detail by reference to FIG. 6. Assume that, between time points *t*1 and *t*2 in FIG. 6, the detected travel distance Lc in the travel distance detection unit 16 becomes "0" as a result

of having been changed, reset, or cleared intentionally or by error. In this event, after the time point *t*2, the detected travel distance Lc varying as represented by a dotted line is sent to the vehicle management center 20. However, at the vehicle management center 20, in the manner described above, the increase ΔL from the previously received detected travel distance Lc(n-1) to the presently received detected travel distance Lc(n) is cumulated to the previous cumulated travel distance La(n-1) stored in the cumulated travel distance storing area 22b of the storage unit 22. Accordingly, although the cumulated travel distance La at the time point *t*2 does not assume a correct value, the cumulated travel distance La after the time point *t*2 assumes a correct travel distance, exclusive of the travel distance between the time points *t*1 and *t*2.

As a result, even if the detected travel distance Lc in the travel distance detection unit 16 has been changed, reset, or cleared intentionally or by error, the cumulated travel distance La computed thereafter is not influenced by such changing, resetting, clearing, or the like, thereby realizing computation of the travel distance of the vehicle. It is therefore possible not only to always provide exact information concerning the travel distance of a vehicle (for example, provision of a time for oil change), but also to provide a correct travel distance to an entity who is influenced by changing, resetting, or clearing of the detected travel distance.

The foregoing description refers to only one embodiment of the present invention. However, the present invention is not limited to the above-described embodiment, and various modifications may be possible without departing from the object of the present invention.

Although, in the present embodiment, a travel distance is adopted as

a quantity indicating a status of a vehicle, various alternative status quantities may be adopted, so long as they are parameters to estimate a future status of a vehicle. For example, the remaining amount of a brake pad may be adopted. In such an alternative, a remaining quantity detection unit for detecting the remaining amount of a brake pad is used instead of the travel distance detection unit 16 of the present embodiment, and the remaining amount of the brake pad, like the travel distance, is successively sent from the on-vehicle terminal apparatus 10 to the vehicle management center 20 as status information indicating the status of the vehicle. Meanwhile, at the vehicle management center 20, the remaining amount of a brake pad from the time of purchase of the vehicle or the time of replacement of the brake pad up to the present time is successively stored, and then a future remaining amount of the brake pad is estimated from variation of the past remaining amount, whereupon the time to replace the brake pad is communicated to the on-vehicle terminal apparatus 10 and the computer 60c of the vehicle dealer. In the alternative also, roughly the same result as that of the above-described embodiment can be expected, and the vehicle dealer can prepare a part; in this case, a brake pad, early enough.

Further, in the above-described embodiment, the mail sending program is executed periodically at the vehicle management center 20 independently of the sending of the vehicle-status information from the on-vehicle terminal apparatus 10 to the vehicle management center 20. Alternatively, the mail sending program may be executed when the detected travel distance Lc serving as vehicle-status information is sent from the on-vehicle terminal apparatus 10 to the vehicle management center 20;

namely, at the time of starting of the engine of the vehicle. In this case as well, when the mail sending program is executed, among the mails stored in the sending mail storage area 22c, a mail to be sent is determined by using the sending data/time which is attached thereto, and is then sent to the on-vehicle terminal apparatus 10, the vehicle dealer's computer 60c, etc.

Furthermore, in the above-described embodiment, cumulated travel distances La(1), La(2)...La(n) are successively calculated up to the present time from the detected travel distances Lc and are stored, and then a future travel distance of the vehicle is estimated from the cumulated travel distances La(1), La(2)...La(n). However, in the absence of any question in relation to changing the detected travel distance Lc in the travel distance detection unit 16 of the vehicle, a future travel distance of the vehicle may be estimated from the travel distances Lc(1), Lc(2)...Lc(n) received up to the present time and stored in the storage unit 22. In this case, in step M20 of the above-described embodiment, the previously received travel distance Lc(n-1) may be used instead of the previous cumulated travel distance La(n-1).

CLAIMS

1. A vehicle management center characterized by comprising:

obtaining means for obtaining from time to time travel distance information measured at a vehicle and indicating a travel distance of the vehicle;

obtained information storing means for storing at least previous travel distance information obtained by the obtaining means;

travel distance calculating means for calculating a travel distance of the vehicle up to the present time by successively cumulating an increase in distance from a previous travel distance to a present travel distance, the previous travel distance being represented by the previous travel distance information stored in the obtained information storing means, the present travel distance being represented by the travel distance information obtained by the obtaining means for the present time.

calculated travel distance storing means for storing the travel distance of the vehicle up to the present time calculated from time to time by the travel distance calculating means;

estimating means for estimating a future cumulated travel distance of the vehicle from the calculated travel distance up to the present time stored in the calculated travel distance storing means; and

information providing means for providing information to the outside according to the estimated future cumulated travel distance.

2. A method of providing information by a vehicle management center, characterized by comprising:

obtaining from time to time travel distance information measured at a vehicle and indicating a travel distance of the vehicle;

storing in a memory at least the obtained previous travel distance information;

calculating a travel distance of the vehicle up to the present time by successively cumulating an increase in distance from a previous travel distance to a present travel distance, the previous travel distance being represented by the stored previous travel distance information, the present travel distance being represented by the travel distance

information obtained for the present time,

storing in the memory the travel distance of the vehicle up to the present time calculated from time to time;

estimating a future cumulated travel distance of the vehicle from the calculated travel distance up to the present time stored in the memory; and

providing information to the outside according to the estimated future cumulated travel distance.

3. A vehicle management center as described in claim 1, wherein the information provided, by the information providing means, includes a time for changing oil.

4. A vehicle management center as described in claim 1, wherein the information provided by the information providing means includes a time for changing a brake pad.

5. A vehicle management center as described in claim 1, wherein the information providing means is composed of:

mail creating and storing means for creating a mail containing the information to be sent to the outside in accordance with the future cumulated travel distance which is estimated by the estimating means, and for storing the created mail with timing information attached thereto, the timing information indicating a timing at which the mail is to be sent; and

sending means for sending the mail stored in the mail creating and storing means to the outside at the timing indicated by the timing information.

6. A method of providing information by a vehicle management center as described in claim 2, wherein the information, provided to the outside includes a time for changing oil.

7. A method of providing information by a vehicle management center as described in claim 2, wherein the information provided to the outside includes a time for changing a brake pad.

8. A method of providing information by a vehicle management center as described in claim 2, wherein

the provision of information to the outside is performed by the steps of:

creating a mail containing information to be sent to the outside in accordance with the estimated future cumulated travel distance of the vehicle, and storing in the memory the created mail with timing information attached thereto, the timing information indicating a timing at which the mail is to be sent; and

sending the mail stored in the memory to the outside at the timing indicated by the timing information.