



A VEHICLE USAGE MANAGEMENT SYSTEM

Field of Invention

The present invention relates to a system for logging information from vehicles. In particular, the present invention relates to a system for tracking vehicle usage.

Background

Urban traffic problems are faced by many cities around the world today. A large population with a strong preference to own and drive vehicles together with a concentration of most economic industries areas in and around business districts in cities have led to severe urban traffic problems such as congestion, reduced traffic speeds, and environmental issues. These problems are further compounded in countries with limited land space. Consequently, owning a vehicle in these countries becomes cost prohibitive due to the different measures introduced by governments to curb the desire of owning vehicles in an effort to solve the aforementioned problems.

Each new vehicle user on the road imposes unfavourable conditions on other existing vehicle users. As roads are built to accommodate a pre-estimated number of vehicles, each additional vehicle slows down other vehicles on the road when the pre-estimated number of vehicles is reached, thus imposing a longer travelling time for all the other vehicle users. Furthermore, vehicles contribute to air pollution, detrimentally affecting the health of a country's population.

One measure adopted by the governments in such countries facing urban traffic problems is to increase the vehicle purchase and ownership costs through tariffs. When used in conjunction with a vehicle quota, this allows the governments to effectively control the total amount of newly registered vehicles. The vehicle quota is reviewed and determined based on road conditions and the number of vehicles permanently deregistered every month.

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A vehicle ownership scheme in turn uses the vehicle quota in determining the ownership of new vehicles. Under the vehicle ownership scheme, anyone wishing to own a vehicle must first bid for a vehicle entitlement certificate. The number of vehicles to be added to the



existing pool of already registered vehicle, which equates to the number of vehicle entitlement certificates to be issued, is determined by subtracting the number of vehicles that are already registered from the vehicle quota. When an individual has successfully obtained a vehicle entitlement certificate, the individual can then proceed to buy a vehicle.

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All newly registered vehicles are categorised as normal vehicles. However, in an effort to further reduce vehicle usage, there are alternative schemes for encouraging vehicles owners to use their vehicles only during off-peak hours. The Off-Peak Car (OPC) scheme is one such alternative scheme. We refer to a vehicle under such a scheme as an OPC hereinafter. OPCs are distinguished from normal cars by refitting them with mandatory OPC car components as required by law, for example, differently coloured registration number plates installed with tamper-proof fittings.

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The OPC scheme provides new and existing vehicle owners with an option to save on vehicle registration fees and road taxes in return for usage of the OPCs only during prescribed periods. If an OPC owner wishes to use the OPC outside the prescribed periods, a valid supplementary single day license needs to be purchased and displayed on the windscreen of the OPC. Failure to display the valid supplementary single day license when the OPC is used outside the prescribed periods is a serious offence.

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A serious problem faced by the OPC scheme is the difficulty in enforcing the mandatory usage of OPCs to only during the prescribed periods. According to a news report, approximately three motorists are caught every two days either for tampering with mandatory OPC car components or for failing to display the supplementary single day license. Presently, dealing with such problems is very laborious, inefficient and unreliable. A group of traffic police inspectors are deployed on the roads to monitor and identify any OPCs being used outside the prescribed periods. If such an OPC is caught being used outside the prescribed periods, the traffic police inspector then issues the OPC driver a summon or a charge ticket to appear before a court of law to receive the appropriate punishments which is dependent on the severity of the committed offence. Although an increasing number of summons and charge tickets have been issued in recent years, there are still many OPC drivers who escape being arrested despite flouting the laws. This is

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largely due to the unreliable nature of the existing method employed to monitor for the illegal usage of OPCs outside the prescribed periods.

5 There is therefore a need for a system to automate the task of monitoring for the illegal usage of OPCs outside the prescribed periods for addressing the problems faced in the existing method.

Summary

10 The present embodiment of the invention disclosed herein provides a vehicle usage management system. By automating the task of monitoring for the illegal usage of OPCs outside the prescribed periods, the disclosed system allows for more effective enforcement of OPCs usage to within the prescribed periods.

15 In accordance with a first aspect of the invention, there is disclosed a vehicle usage management system comprising a data module, an owner module, a processing module and a result module. The data module is for receiving vehicle data provided by a vehicle unit disposed in a vehicle, the vehicle data being generated when the vehicle is in use and the owner module is for retrieving owner data from an owner database, the owner data corresponding with the vehicle data and identifying an owner of the vehicle. The
20 processing module compares the vehicle data with a plurality of usage rules for determining a vehicle usage status. The plurality of usage rules is pre-determined and the vehicle usage status is one of valid use and invalid use. Finally, the result module is for generating a violation result from the vehicle data and the plurality of usage rules when invalid use of the vehicle is determined, wherein the violation result is subsequently
25 provided to the owner of the vehicle.

In accordance with a second aspect of the invention, there is disclosed a vehicle usage management method. The method comprises the step of receiving vehicle data provided by a vehicle unit disposed in a vehicle in a data module. The vehicle data is generated
30 when the vehicle is in use. Further, the method also comprises the step of retrieving owner data from an owner database by an owner module. The owner data corresponds with the vehicle data and identifies an owner of the vehicle. Additionally, the method involves the step of comparing the vehicle data with a plurality of usage rules by a processing module

for determining a vehicle usage status in which the plurality of usage rules is pre-determined and the vehicle usage status is one of valid use and invalid use. Lastly, the method generates a violation result from the vehicle data and the plurality of usage rules by a result module when invalid use of the vehicle is determined. The violation result is subsequently provided to the owner of the vehicle.

In accordance with a third aspect of the invention, there is disclosed a computer program product comprising a computer readable medium having a computer program code. The computer program code is loadable for making the computer execute the step of receiving vehicle data provided by a vehicle unit disposed in a vehicle in a data module. The vehicle data is generated when the vehicle is in use. The computer then further executes the step of retrieving owner data from an owner database by an owner module. The owner data corresponds with the vehicle data and identifies an owner of the vehicle. Additionally, the computer further executes the step of comparing the vehicle data with a plurality of usage rules by a processing module for determining a vehicle usage status, the plurality of usage rules being pre-determined and the vehicle usage status being one of valid use and invalid use. Lastly, the computer executes the step of generating a violation result from the vehicle data and the plurality of usage rules by a result module when invalid use of the vehicle is determined. The violation result is then subsequently provided to the owner of the vehicle.

Brief Description Of The Drawings

Embodiments of the invention are disclosed hereinafter with reference to the drawings, in which:

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FIG. 1 shows a block diagram of client and server side components of a vehicle usage management system according to an embodiment of the invention;

FIG. 2 shows a block diagram of system components of a data-logging unit being disposable in a vehicle for use in conjunction with the vehicle usage management system of FIG. 1;

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FIG. 3 shows a block diagram of the inputs and outputs of the data-logging unit of FIG.2 for recording operating parameters of the vehicle when the vehicle is in use;

FIG. 4 shows a flowchart illustrating a process for vehicle data retrieval by a base station from the data-logging unit of the vehicle when the vehicle is in communication range of the base station using the vehicle usage management system of FIG. 1; and

FIG. 5 shows a flowchart illustrating a process for vehicle data retrieval with CCTV video recordings by the base station from the data-logging unit of the vehicle when the vehicle is in communication range of the base station using the vehicle usage management system of FIG. 1.

Detailed Description

A vehicle usage management system 100 for monitoring and identifying vehicles in violation of predefined usage rules, for example traffic rules, is described hereinafter for addressing the foregoing problems. As outlined above, an embodiment of the invention provides a system for exchanging, processing and storing vehicle data received from a plurality of vehicles.

For purposes of brevity and clarity, the description of the invention is limited hereinafter for use in systems for monitoring and identifying vehicles in violation of predefined usage traffic rules. This however does not preclude various embodiments of the invention from other applications that require similar operating performance as the systems for monitoring and identifying vehicles in violation of predefined usage traffic rules. The operational and functional principles fundamental to the embodiments of the invention are common throughout the various embodiments.

Embodiments of the invention described hereinafter are in accordance with FIGs. 1 to 5 of the drawings, in which like elements are numbered with like reference numerals.

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With reference to FIG. 1, which shows an overview of the system configuration setup for the vehicle usage management system 100, an embodiment of the invention is described. The system configuration setup for the vehicle usage management system 100 comprises a

mobile subsystem 102 and a base-data-management subsystem 104. On the mobile subsystem 102, a vehicle-data-logging device 106 for logging vehicle data is pre-installed, either internally or externally, on a vehicle (not shown) preferably by designated vehicle installation centers. The vehicle-data-logging device 106 includes the system components
5 of a primary transceiver 108 and a data-logging unit 110.

The primary transceiver 108 is preferably structurally decouplable from the data-logging unit 110 so that the adoption of a new wireless communication technology for vehicle data exchange can easily be implemented when improved wireless communication technologies
10 are available. The data-logging unit 110 is for logging a vehicle data (not shown) from the vehicle only when the vehicle is in use.

On the base-data- management subsystem 104, data collection points 112 situated at different localities are connected to a central management system 114 preferably via wired
15 links 116. Each data collection point 112 comprises a secondary transceiver 118 and a base station 120. The data collection point 112 is preferably situated at access-convenient locations where vehicles are likely to make stops in the course of use, for example at petrol kiosks, custom checkpoints or vehicle installation centers.

20 When the vehicle approaches any one of the data collection points 112 within a wireless zone, the primary transceiver 108 and the secondary transceiver 118 come within substantial communication range of each other. The vehicle data is then transmitted from the primary transceiver 108 of the vehicle-data-logging device 106 to the secondary transceiver 118 of the data collection point 112 via a wireless link 122. The type of
25 wireless technology adopted by the vehicle usage management system 100 for establishing communication links between the primary transceiver 108 and the secondary transceiver 118 determines a range of distances at which the primary transceiver 108 is in proximity of the secondary transceiver 118 before they are within communication range of each other. The wireless link 122 is established using an existing commercially available networking
30 standard and, preferably employing radio-based technologies such as Wireless Fidelity (WiFi) or Worldwide Interoperability for Microwave Access (WiMax). Each data collection point 112 is equipped with the capability to simultaneously carry out data

collection from multiple mobile subsystems 102 that are within the wireless zone of the data collection point 112.

Referring to FIG. 2, system components of the vehicle-data-logging device 106 further include a memory unit 200, an ID transponder 202, status LEDs 204, and a battery unit 206. The memory unit 200 functions as an internal temporary storage location for storing the vehicle data recorded by the data-logging unit 110 when the vehicle is in operation. The memory unit 200 is preferably a flash memory unit of type NAND to enable the recorded vehicle data to be retained in the memory unit 200 even in the absence of power. The vehicle data is only deleted from the memory unit 200 when the vehicle data is uploaded to the data collection point 112 during a vehicle data-uploading phase. To uniquely identify each vehicle's vehicle data when uploading the vehicle data to the data collection point 112, the data-logging unit 110 is affixed with the ID transponder 202. The ID transponder 202 relays a unique identification number, corresponding to the vehicle on which the data-logging unit 110 is installed, to the data collection point 112 during the vehicle data-uploading phase.

In addition, the data-logging unit 110 is also installed with a series of status LEDs 204. The status LEDs 204 are light indicators for indicating the status associated with the operating status of the data-logging unit 110. The operating status preferably includes a low battery status, a fault status and a data transmission-in-progress status (all not shown). In order to keep the data-logging unit 110 functioning even when the vehicle is switched off, for example during refuelling of the vehicle or when the vehicle is parked, the data-logging unit 110 is further powered by a separate battery unit 206. The data-logging unit 110 needs to be kept powered in order to maintain system functionalities such as clock timing even when the vehicle's power supply to the data logging unit 110 is switched off.

FIG. 3 illustrates data input to and data output from the data-logging unit 110. As shown, the data-logging unit 110 installed on the vehicle receives data input from the vehicle relating to operating parameters of the vehicle when the vehicle is in use. The data input comprises on or off status of the vehicle 300, date and time of vehicle usage 302, odometer readings 304 and the maximum speed clocked by the vehicle 306. The data output generated by the data-logging unit 110 include information relating to vehicle usage 308

(e.g., vehicle maintenance), usage information 310 (e.g., frequency of vehicle usage), mileage information 312 (e.g., the total distance clocked by the vehicle within a period), and speed information 314 (e.g., how often the vehicle travels within the allowed speed limits). The data output forms a portion of the vehicle data for subsequent transmission to the central management system 114.

With reference to FIG 4, which shows a flowchart illustrating the process whereby the vehicle data is retrieved by the data collection point 112 from the data-logging unit 110, the data collection point 112 constantly monitors within the wireless zone for presence of any vehicle installed with the vehicle-data-logging device 106 in a step 402. A course of action to take is then decided in a step 404 based on the presence or absence of such a vehicle. The coverage of the wireless zone around the data collection point 112 depends on the type of wireless communication technology employed by the vehicle usage management system 100. If no vehicle installed with the vehicle-data-logging device 106 is detected, the data collection point 112 repeats step 402 until such a vehicle is detected. However, if a vehicle installed with the vehicle-data-logging device 106 is detected, the data collection point 112 then proceeds to authenticate the vehicle and perform a cross system status check with the vehicle-data-logging device 106 in a step 406.

When the step 406 is completed, the data collection point 112 then downloads the vehicle data from the vehicle's data-logging unit 110 in a step 407 onto the data collection point 112 where the received vehicle data is temporary stored. To ensure that the data-logging unit 110 and the data collection point 112 are operating according to a common timeframe, the data collection point 112 performs time and date synchronization on the vehicle 112 in a step 408. The data collection point 112 also periodically uploads all collected vehicle data received from a plurality of vehicles to the central management system 114. The data collection point 112 first checks if a scheduled time for uploading all collected vehicle data to the central management system 114 in a step 410 is reached. For convenience, steps 407, 408 and 410 are grouped as step 412 in FIG. 4. Following the step 410, uploading of the vehicle data to the central management system 114 is decided in a step 414. When it is still not the scheduled time for uploading all collected vehicle data to the central management system 114, the data collection point 112 returns to the step 402 to continue monitoring for the presence of any new entered vehicle within the wireless zone, installed

with the vehicle-data-logging device 106. However, when the scheduled time is reached, the data collection point 112 then uploads all collected vehicle data via the wired link 116 to the central management system 114 in a step 416.

- 5 The vehicle data received by the central management system 114 is then processed by comparing the vehicle data with a set of pre-defined usage rules. The set of predefined usage rules comprises prescribed periods of the day for each day of the week or year when use of the vehicle is permitted and therefore determined as valid use of the vehicle. Use of the vehicle outside the prescribed periods is determined as invalid use of the vehicle.
- 10 Additionally, the set of pre-defined usage rules contain provisions where use of the vehicle outside of the prescribed periods but under allowable conditions is also determined as valid use of the vehicle.

- 15 The allowable conditions include repositioning of the vehicle or moving of the vehicle over very short distances which can be determined by analyzing the mileage information 312 or the speed information 314. The allowable conditions further include use of the vehicle in a foreign jurisdiction or country. By situating one or more of the data collection points 112 at customs and immigration checkpoints, the unique identification number provided by the ID transponder 202 of the vehicle passing through the customs and
- 20 immigration checkpoints is captured and recorded by the data collection point 112 and sent to the central management system 114. This enables use of the vehicle outside the prescribed periods but in a foreign country to be still considered as valid use of the vehicle during processing of the vehicle data by the central management system 114.

- 25 When invalid use of the vehicle is identified by the central management system 114, details of the vehicle owner corresponding to the unique identification number of the ID transponder 202 is retrieved from an owner database (not shown). A violation result, in the form of a summon to appear in a court of law, a charge ticket or a notice of offence is then provided by mail or electronic mail to the vehicle owner informing the vehicle owner of a
- 30 traffic offence resulting from the invalid use of the vehicle. Alternatively, the relevant governmental department or ministries generates and provides the violation result to the vehicle owner.

Further to the process illustrated in FIG 4, CCTV cameras can also be installed at strategic places substantially near the vehicular entrances and exits of compounds where the data collection points 112 are located. The CCTV cameras are used for capturing video recordings of the vehicles entering and leaving the data collection point 112. Similar to the received vehicle data, the captured video recordings are temporary stored on the data collection point 112 for uploading to the central management system 114 when required. Alternatively, snippets of the video recordings are generated and uploaded to the central management system 114 in order to prevent overloading of the data transmission bandwidth. With reference to FIG. 5, upon completion of vehicle authentication on and cross system status check with the vehicle-data-logging device 106 in the step 406, the data collection point 112 then activates the CCTV cameras to capture the video recordings of the vehicle in a step 502. The subsequent steps are similar to the process illustrated in FIG. 4.

In the foregoing manner, a vehicle usage management system 100 for tracking vehicle usage is described according to one embodiment of the invention for addressing the foregoing disadvantages of conventional vehicle usage tracking approaches. Although only one embodiment of the invention is disclosed, it will be apparent to one skilled in the art in view of this disclosure that numerous changes and/or modification can be made without departing from the scope and spirit of the invention.

Claims

1. A vehicle usage management system comprising:
 - a data module for receiving vehicle data provided by a vehicle unit disposed in a vehicle, the vehicle data being generated when the vehicle is in use;
 - 5 an owner module for retrieving owner data from an owner database, the owner data corresponding with the vehicle data and identifying an owner of the vehicle;
 - a processing module for comparing the vehicle data with a plurality of usage rules for determining a vehicle usage status, the plurality of usage rules being pre-determined and the vehicle usage status being one of valid use and invalid use;
 - 10 and
 - a result module for generating a violation result from the vehicle data and the plurality of usage rules when invalid use of the vehicle is determined, wherein the violation result is subsequently provided to the owner of the
 - 15 vehicle.
2. The vehicle usage management system as in claim 1, further comprising:
 - a transceiver for receiving the vehicle data provided by the vehicle unit and for providing the vehicle data to the data module.
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3. The vehicle usage management system as in claim 2, wherein the vehicle data is provided by the vehicle unit to the transceiver when the vehicle is within a pre-defined distance from the transceiver.
- 25 4. The vehicle usage management system as in claim 1, the vehicle data comprising:
 - date and time of use of the vehicle; and
 - distance travelled by the vehicle corresponding with the date and time of use of the vehicle.
- 30 5. The vehicle usage management system as in claim 4, the vehicle data further comprising:
 - speed of the vehicle corresponding with the date and time of use of the vehicle.

6. The vehicle usage management system as in claim 4, the vehicle data further comprising:

location of the vehicle corresponding with the date and time of use of the vehicle.

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7. The vehicle management system as in claim 1, the vehicle unit comprising:

a memory unit for storing the vehicle data generated;

a battery unit for powering the memory unit;

a transceiver for transmission of the vehicle data for provision to the data

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module; and

an identification (ID) transponder corresponding to and identifying the vehicle,

wherein the identification (ID) transponder is registered to the owner of the vehicle.

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8. A vehicle usage management method comprising the steps of:

receiving vehicle data provided by a vehicle unit disposed in a vehicle in a data module, the vehicle data being generated when the vehicle is in use;

retrieving owner data from an owner database by an owner module, the

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owner data corresponding with the vehicle data and identifying an owner of the vehicle;

comparing the vehicle data with a plurality of usage rules by a processing module for determining a vehicle usage status, the plurality of usage rules being pre-determined and the vehicle usage status being one of valid use and invalid use;

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and

generating a violation result from the vehicle data and the plurality of usage rules by a result module when invalid use of the vehicle is determined,

wherein the violation result is subsequently provided to the owner of the vehicle.

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9. The vehicle usage management method as in claim 8, further comprising the step of:

providing a transceiver for receiving the vehicle data provided by the vehicle unit and for providing the vehicle data to the data module.

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10. The vehicle usage management method as in claim 9, the step of receiving vehicle data provided by a vehicle unit comprising the step of:

transmitting the vehicle data from the vehicle unit to the transceiver when the vehicle is within a pre-defined distance from the transceiver.

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11. The vehicle usage management method as in claim 8, the step of receiving vehicle data comprising the step of:

receiving date and time of use of the vehicle; and

receiving distance traveled by the vehicle corresponding with the date and time of use of the vehicle.

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12. The vehicle usage management method as in claim 11, the step of receiving vehicle data further comprising the step of:

receiving speed of the vehicle corresponding with the date and time of use of the vehicle.

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13. The vehicle usage management method as in claim 11, the step of receiving vehicle data further comprising the step of:

receiving location of the vehicle corresponding with the date and time of use of the vehicle.

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14. The vehicle management method as in claim 8, the step of receiving vehicle data provided by a vehicle unit comprising the step of:

providing a vehicle unit comprising:

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a memory unit for storing the vehicle data generated;

a battery unit for powering the memory unit;

a transceiver for transmission of the vehicle data for provision to the data module; and

an identification (ID) transponder corresponding to and identifying the vehicle,

wherein the identification (ID) transponder is registered to the owner of the vehicle.

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15. A computer program product comprising a computer readable medium, having thereon a computer program code, wherein the computer program code is loadable for making the computer execute the steps of:

10 receiving vehicle data provided by a vehicle unit disposed in a vehicle in a data module, the vehicle data being generated when the vehicle is in use;

retrieving owner data from an owner database by an owner module, the owner data corresponding with the vehicle data and identifying an owner of the vehicle;

15 comparing the vehicle data with a plurality of usage rules by a processing module for determining a vehicle usage status, the plurality of usage rules being pre-determined and the vehicle usage status being one of valid use and invalid use; and

generating a violation result from the vehicle data and the plurality of usage rules by a result module when invalid use of the vehicle is determined,

20 wherein the violation result is subsequently provided to the owner of the vehicle.

16. The computer program product as in claim 15, further executing the step of:

25 providing a transceiver for receiving the vehicle data provided by the vehicle unit and for providing the vehicle data to the data module.

17. The computer program product as in claim 16, the step of receiving vehicle data provided by a vehicle unit comprising the step of:

30 transmitting the vehicle data from the vehicle unit to the transceiver when the vehicle is within a pre-defined distance from the transceiver.

18. The computer program product as in claim 15, the step of receiving vehicle data comprising the step of:

receiving date and time of use of the vehicle; and
 receiving distance traveled by the vehicle corresponding with the date and
 time of use of the vehicle.

5 19. The computer program product as in claim 18, the step of receiving vehicle data
 further comprising the step of:
 receiving speed of the vehicle corresponding with the date and time of use
 of the vehicle.

10 20. The computer program product as in claim 18, the step of receiving vehicle data
 further comprising the step of:
 receiving location of the vehicle corresponding with the date and time of
 use of the vehicle.

15 21. The computer program product as in claim 15, the step of receiving vehicle data
 provided by a vehicle unit comprising the step of:
 providing a vehicle unit comprising:
 a memory unit for storing the vehicle data generated;
 a battery unit for powering the memory unit;
 20 a transceiver for transmission of the vehicle data for provision to the
 data module; and
 an identification (ID) transponder corresponding to and identifying
 the vehicle,
 wherein the identification (ID) transponder is registered to the owner
 25 of the vehicle.