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MONITORING SYSTEM

5 THIS INVENTION relates to a monitoring system.
It also relates to a method of monitoring movement
from a selected zone. Further, it relates to a method
of monitoring the use of at least one vehicle and to a
primary electronic tag.

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Identification tags such as electronic tags, e.g.
transponder tags, are commonly available in the market
place. Such tags are often carried by employees to
control access to and from a building. Such employees
15 may however be of devious intent and, upon departing,
selected objects, e.g. valuable goods such as laptop
computers or the like, may be stolen. It is an
object, inter alia, of this invention to offer a
solution to this problem. Inventors in the past have
20 offered possible solutions to this problem. For
example, in USA 5,396,218 (George OLAH), a portable
security system is disclosed which is based on
maintaining wireless communication between two or more
plastic cards within a defined range. The disclosure
25 requires that the two cards be maintained within a
predetermined distance failing which an alarm is
triggered. This system is, however, not suitable for
use in monitoring the movement of articles where the
article need not continually be in close proximity to
30 a plastic card.

In accordance with the invention, there is
provided a monitoring system characterized in that it
includes a primary electronic tag including primary
identification data and associated with a primary
35 bearer of the tag;
a secondary electronic tag including secondary
identification data and associated with a secondary

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bearer of the tag, the secondary identification data
being associated with the primary identification data;
reading apparatus for remotely reading the primary
identification data from the primary electronic tag
5 and remotely reading the secondary identification data
from the secondary electronic tag; and
comparator means operable to compare the secondary
identification data and the primary identification
data and generate an output signal dependent upon an
10 outcome of the comparison.

Typically the system includes a plurality of secondary electronic tags associated with the primary electronic tag, each secondary electronic tag including secondary identification data which identifies the secondary bearer to which it is attached and which is identified by the primary identification data.

5 In certain embodiments of the invention, the primary electronic tag is carried in use by a person and the secondary electronic tag includes secondary attachment means configured fixedly to attach it to the secondary bearer in the form an item of value e.g. a laptop computer or the like.

 The primary identification data may include an inventory of valuable
10 items which the bearer is authorised to remove from a particular zone, each item including a secondary electronic tag which is identified by the primary identification data.

 The system may include alarm apparatus responsive to the output signal for generating an alarm signal when the bearer of the primary electronic tag
15 is not authorised to remove the valuable item from the zone. The system may include a security control arrangement, e.g. a turn-style or the like, responsive to the control signal and operable selectively to inhibit departure of the person from the zone if the valuable item is not included in the inventory. The access control arrangement is typically operable to allow access when selected identification
20 data included in the primary and secondary identification data match.

 The primary electronic tag may be a conventional electronic tag, e.g. a transponder tag, an active electronic tag including a transmitter only, or the like.

 The primary identification data of the primary electronic tag may include identification data which identifies the authorised person, e.g. the
25 person's name or the like. Accordingly, the electronic tag may have storage means for storing the primary identification data on the tag.

The secondary electronic tag may also be a conventional electronic tag. The secondary electronic tag typically includes storage means to store the secondary identification data and, optionally, the primary identification data.

Typically, the system comprises a plurality of secondary electronic
5 tags, each tag including secondary identification data which identifies an object to which it is uniquely associated. Accordingly, for example, any one of a variety of goods may be associated with the authorised person. The system may include alarm means for generating an alarm signal when the person is not authorised to remove the object.

10 Typically, the primary electronic tag includes a plurality of secondary identification data, each item of secondary identification data being uniquely associated with a secondary electronic tag uniquely associated with a particular object to which the tag is associated, typically, securely attached thereto. Thus, the primary identification data may define a so-called "asset list" or "object list"
15 which the bearer of the primary electronic tag may, for example, be authorised to remove from the selected zone, typically business premises, via an access control point.

In certain embodiments of the invention, the primary electronic tag includes primary attachment means configured releasably to attach it to the
20 primary bearer which is in the form of a person and the secondary electronic tag includes secondary attachment means configured releasably to attach it to the secondary bearer which is also in the form a person.

The secondary identification data may identify a child under the supervision of the bearer of the primary electronic tag and the comparator may
25 generate an output signal in the form of an alarm signal when the primary and secondary electronic tags are not within a predetermined zone covered by the reading apparatus.

The system may include a plurality of reading apparatus each covering a different predetermined zone forming part of a public area e.g. a theme park such as Disney WorldTM or the like. The comparator may operable to process the primary identification data and verify that all secondary electronic
5 tags identified by the primary identification data are located within the predetermined zone covered by associated reading apparatus failing which an output signal in the form of an alarm signal is generated.

In other embodiments of the invention, the primary electronic tag is issued in use to a person authorised to use at least one selected vehicle and the
10 secondary electronic tag is uniquely associated with and attached in use to the selected vehicle, the output signal indicating if the person is authorised to use the vehicle. Accordingly, the system may include disabling means responsive to the output signal and connected in use to an electrical system of the vehicle and operable selectively to disable the vehicle. The disabling means may be a
15 conventional vehicle disabling arrangement for disabling the vehicle when the secondary and primary identification do not match.

Typically, the secondary electronic tag is located in a fuel tank of the vehicle.

The primary and secondary electronic tags may be active tags
20 including an RF transmitter for intermittently transmitting the identification data.

The primary and secondary electronic tags may be programmed with the primary and secondary identification data in a wireless fashion.

The secondary and/or primary electronic tags may include tamper detection means for detecting tampering with the tag e.g. an attempt to remove
25 it from the bearer.

The primary electronic tag may be a portable tag which may be, for

example, attached to clothing or the like of the person, located in a pocket of the authorised person, or the like. The primary electronic tag may be arranged to perform similar functions as a conventional tag, e.g. time reporting or the like.

Still further in accordance with the invention, there is provided a
5 primary electronic tag for use in monitoring movement of at least one secondary electronic tag, the primary electronic tag including primary identification data programmed to identify a bearer of the primary electronic tag in use and identify the secondary electronic tag.

The primary identification data may include an inventory of a plurality
10 of secondary electronic tags associated with the primary electronic tag. The primary electronic tag may include a transmitter for intermittently transmitting a signal including the primary identification data to reading apparatus.

Further in accordance with the invention, there is provided a method
of monitoring movement from a selected zone, the method including
15 reading primary identification data from a primary electronic tag issued to a primary bearer of the primary electronic tag;
reading secondary identification data from a secondary electronic tag associated with a secondary bearer of the secondary electronic tag, the secondary identification data being associated with the primary identification data which
20 defines authorised movement of the secondary bearer; and
comparing the secondary identification data and the primary identification data to monitor movement of the secondary bearer from the selected zone.

The method may include fixedly attaching the secondary electronic tag to an item of value thereby to monitor unauthorised removal of the item of
25 value from the selected zone.

The method may include
issuing the primary electronic tag to a person supervising at least one child;

issuing a secondary electronic tag to the child, the secondary electronic tag including unique identification data to identify the child and which is intermittently transmitted;

programming the primary electronic tag with the primary identification data
5 and the secondary electronic tag with the secondary identification data; and
generating an alarm signal when the child and the supervisor are not in the same zone.

A plurality of children may each be issued with a secondary electronic tag and the primary identification data includes an inventory of the
10 secondary electronic tags with which it is associated.

The method may include controlling operation a security control arrangement in response to the comparison selectively to inhibit departure of the primary bearer from the zone.

Still further in accordance with the invention, there is provided a
15 method of monitoring the use of at least one vehicle, the method including
issuing a primary electronic tag including primary identification data to a person authorised to drive a particular vehicle;
providing the vehicle with a secondary electronic tag which includes secondary identification data associated with the primary identification data;
20 reading the primary and secondary identification data in a wireless fashion when the person occupies the vehicle; and
comparing the primary and secondary identification data thereby to monitor use of the vehicle.

The method may include selectively disabling the vehicle in response
25 to the comparison. For example, a conventional vehicle immobilising system may be activated.

The invention is now described, by way of example, with reference

to the accompanying diagrammatic drawings.

In the drawings,

Figure 1 shows a schematic diagram of an access control system in accordance with the invention;

5 Figure 2 shows a schematic diagram of a vehicle control system, also in accordance with the invention, for controlling use of a vehicle;

Figure 3 shows a schematic diagram of installation of electronic tags for use in the vehicle control system of Figure 2; and

Figure 4 shows a schematic block diagram of various optional installations
10 of reading apparatus for reading the electronic tags of the control systems of Figure 2.

Referring to the drawings, reference numeral 10 generally indicates a monitoring system in the form of an access control system in accordance with the invention. The system 10 includes a primary electronic tag 12 carried by an
15 authorised primary bearer 14 of the tag 12, a secondary electronic tag 16 which is fixedly mounted to a secondary bearer in the form of an object such as a laptop computer 18, reading apparatus 20, an optional host computer 22, and an access control arrangement 24. The reading apparatus 20 includes a comparator 26
20 which is operable to compare selected data received from both the primary and secondary electronic tags 12, 16 and, in response to the comparison, allow or deny access of the bearer 14 to or from a selected zone, typically business premises or the like.

The primary electronic tag 14 is an active tag including its own power supply unit which typically includes a long-life lithium battery. The primary
25 electronic tag 12 has storage means in which primary identification data is programmed. The data may be programmed remotely in a conventional wireless fashion into the primary electronic tag 12 or via hardwired connections. The primary identification data is uniquely associated with the authorised bearer 14 and includes details such as the name and other identification details of the

authorised bearer 14. The primary electronic tag 12 intermittently transmits the primary identification data via an RF signal which is received by the reading apparatus 20 when the bearer 14 passes the access control point. In other embodiments of the invention, the primary electronic tag 12 is a transponder tag or the like which is interrogated in a conventional fashion.

The secondary electronic tag 16 is substantially similar to the primary electronic tag 12 and includes unique secondary identification data which identifies the laptop computer 18 to which it is attached. Preferably, the secondary electronic tag 16 is attached to the laptop computer 18 in such a fashion so that it is concealed and not easily removed from the laptop computer 18. Preferably, the secondary electronic tag 16 includes a tampering sensor or the like for sensing when a person of devious intent attempts to remove the secondary electronic tag 16 from the laptop computer 18. The secondary electronic tag 16 is also an active tag. It includes a long-life lithium battery and intermittently transmits the secondary identification data so that when it passes the access control point the reading apparatus 20 may receive the secondary identification data.

As mentioned above, the secondary identification data is uniquely associated with a particular object, namely the laptop computer 18, to which it is attached. However, the primary identification data of the primary electronic tag 12 includes data associated with a variety of different secondary electronic tags 16. Thus, the storage means of the primary electronic tag 12 may include a plurality of secondary identification data which defines a so-called "asset list" or inventory defining various different assets to which various different secondary electronic tags 16 are attached. Each object or item which the authorised bearer 14 is authorised to remove or transport past the access control arrangement 24 is included in the asset list.

When the bearer 14 approaches the access control point, the reading apparatus 20 receives signals from both the primary and the secondary electronic

tags 12, 16, and the primary and secondary identification data respectively included in the signals is fed into the comparator 26. If the secondary identification data matches the selected primary identification data, the comparator is operable to generate a control signal which is fed to the access
5 control arrangement 24 to allow access of the bearer 14 to or from the selected zone as the case may be. However, if the bearer 14 is not authorised to remove the laptop computer 18 (or any other item which he or she may be carrying with its associated secondary electronic tag) from the selected zone, the comparator 26 will ascertain this when comparing selected primary and secondary
10 identification data and, optionally, deny access to or from the selected zone by means of the access control arrangement 24. Thus, the primary electronic tag 12 defines a list of assets each of which are fitted with a secondary electronic tag 16 which the bearer 14 is authorised to remove from various zones, for example, business premises.

15 In certain embodiments of the invention, the reading apparatus 20 is connected to the host computer 22 which is operable to store selected information sourced from the primary and secondary electronic tags 12, 16. For example, the host computer 22 may store information from the primary electronic tag 12, such as the person to whom the primary electronic tag 12 was issued,
20 and thereby monitor what assets are being removed from the selected zone or business premises by the bearer 14.

Referring in particular to Figures 2 to 4 of the drawings, reference numeral 30 generally indicates a vehicle control system, also in accordance with the invention, for controlling the use of a vehicle 32. The control system 30
25 includes a secondary electronic tag 16, a primary electronic tag 12, and vehicle immobilising apparatus 34. The immobilising apparatus 34 includes reading apparatus 20 which is operable to read primary identification data and secondary identification data from the primary electronic tag 12 and the secondary electronic tag 16 respectively. The reading apparatus 20 includes a comparator which is
30 operable to compare selected primary and secondary identification data and, in

response thereto, activate or deactivate the immobilising apparatus 34. The immobilising apparatus 34 is typically connected to the vehicle power supply and may include its own rechargeable battery.

In a similar fashion as described above, the primary electronic tag 12
5 has storage means which includes the primary identification data which relates to and is associated with various secondary electronic tags 16 thus defining which vehicles the bearer of the primary electronic tag 12 is authorised to drive. Thus, in a similar fashion as described above, the data of the primary electronic tag 12 and the secondary electronic tag 16 is compared and, dependent upon the
10 result of the comparison, the vehicle is either immobilised or activated. The secondary electronic tag 16 is typically inserted into a fuel tank of the vehicle either during manufacture of the vehicle or subsequently as shown in Figure 3.

Referring in particular to Figure 4 of the drawings, the reading
apparatus 20 may include a plurality of readers which are located at selected
15 locations, e.g. at various positions along toll roads 36, at border posts 38, at police stations 40, at vehicle recovery pounds 42, at access points to home or office parking 44, at service garages 46, at fuel sale garages 48, and in police and traffic vehicles 50. Typically, the readers 36 to 50 are connected via communication networks 52 to a central authority 54 which may then process
20 the data and report on the location of, for example, hot listed stolen vehicles which are identified by their unique secondary electronic tag 16. Further readers may be provided at autoclub breaddown points 54 and linked to various other points via communication links 56, e.g. to a head office of an autoclub 55. The readers 36 to 50 in certain embodiments of the invention are fixed units which
25 are fitted at the various points, and in other embodiments of the invention, they are hand-held readers.

The immobilising apparatus 34 may, dependent upon the comparison between selected primary identification data and secondary identification data, immobilise the vehicle immediately, immobilise the vehicle after a predetermined

time delay, activate flashing lights, activate a hooter of the vehicle, or cut off the fuel or ignition lines of the vehicles. Typically, the immobilising apparatus 34 includes a microprocessor based controller which can store data such as the service history of the vehicle, its owner, its insurer, its financier, or the like.

5 Thus, the immobilising apparatus 34 with its internal storage means may retain a complete history of the vehicle including driving parameters, odometer readings or the like. The primary identification data of the primary electronic tag 12 may typically include driver identification details, medical doctor details, next of kin details, AA number, insurance details or the like. Likewise, the secondary
10 identification data of the secondary electronic tag 16 may include comprehensive details of the vehicle 32. In certain embodiments of the invention, the vehicle 32 would automatically be immobilised or activated when a driver bearing the primary electronic tag 12 climbs into or out of the vehicle 12.

- In other embodiments of the invention, the primary electronic tag 12
15 may include details of a financial nature. Accordingly, the primary and secondary electronic tags 12, 16 may, for example, be used to verify credit transactions in which event the secondary electronic tag 16 may be included in a credit card or the like. In other embodiments the financial transactions may extend to invoicing of goods purchased. In other embodiments, the primary or secondary electronic
20 tags 12, 16 may activate fuel dispensing pumps.

In yet further embodiments of the invention, the primary electronic tag 12 may be issued to a supervisor or parent supervising several children. Each child is then issued with a secondary electronic tag 16 which has attachment means for releasably attaching it to the child. The primary identification data then
25 includes an "inventory" or list of the secondary identification data which identifies each child. For example, a plurality of reading apparatus may be located in a theme park, each reading apparatus monitoring a particular zone within the theme park. The reading apparatus then intermittently receive the primary and secondary identification data and monitor if all the secondary electronic tags 16
30 (and thus all the children) listed or identified in the primary identification data are

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within the same zone. If not, an alarm signal may be generated. In a similar fashion to the access control system 10, a secondary electronic tag 16 may be attached to a child to inhibit unauthorised removal of a child from a particular zone or area.

It is to be appreciated that the monitoring system including the primary electronic tags 12 with data on a plurality of secondary electronic tags 16 may be used in a large variety of different applications in which one or more supervisors monitor a plurality of people. For example, a tour guide may be issued with a primary electronic tag 12 which has data on a plurality of secondary electronic tags 16 issued to members of a tour group. The primary and secondary electronic tags 12, 16 may, for example, be monitored to ensure all the members have embarked on a bus after visiting a particular tourist attraction.

The Inventor believes that the invention, as illustrated, provided a relatively simple and cost effective electronic tag arrangement with enhanced operating characteristics so that it may be used in a variety of different applications.

In prior art systems, an identification device may be fitted to an item of value so that unauthorised removal of the item of value may be monitored. Such systems may require reading apparatus to be in close proximity to the article and, when the distance between the reading apparatus exceeds a particular distance, an alarm may be sounded as disclosed in USA 5,396,218 (George OLAH). These types of systems have several disadvantages, for example, they are not suitable when an article may be removed from a selected zone monitored by reading apparatus by an authorised person. Further, they merely raise an alarm and no data logging or the like takes place. The system 10, in accordance with the invention, with its reading apparatus and primary electronic tag 12,

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which may have a plurality of associated secondary
electronic tags 16, may log or monitor removal of an
item and identify (e.g. in host computer system) the
particular person that is removing the article from
5 the selected zone by reading of the primary electronic
tag 12. Depending on the privileges granted to the
bearer of the primary electronic tag 12, the event may
merely be logged, an alarm can be raised, and so on.

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CLAIMS

1. A monitoring system (10) which includes
a primary electronic tag (12) including primary identification data and associated with a primary bearer (14) of the tag (12);
a secondary electronic tag (16) including secondary identification data and associated with a secondary bearer (18) of the tag (16), the secondary identification data being associated with the primary identification data characterized in that the system includes reading apparatus (20) for remotely reading the primary identification data from the primary electronic tag (12) and remotely reading the secondary identification data from the secondary electronic tag (16); and
comparator means (26) operable to compare the secondary identification data and the primary identification data and generate an output signal dependent upon an outcome of the comparison.
2. A system (10) as claimed in Claim 1, characterized in that it includes a plurality of secondary electronic tags (16) associated with the primary electronic tag (12), each secondary electronic tag (16) including secondary identification data which identifies the bearer (18) to which it is attached and which is identified by the primary identification data.
3. A system (10) as claimed in Claim 1 or Claim 2, characterized in that the primary electronic tag (12) is carried in use by a person (14) and the secondary electronic tag (16) includes secondary attachment means configured fixedly to attach it to the secondary bearer (18) in the form an item of value.

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4. A system (10) as claimed in Claim 3,
characterized in that the primary identification data
includes an inventory of valuable items which the
bearer (14) is authorised to remove from a particular
5 zone monitored by the reading apparatus, each item
including a secondary electronic tag (16) which is
identified by the primary identification data.

5. A system (10) as claimed in Claim 4,
10 characterized in that it includes alarm apparatus
responsive to the output signal for generating an
alarm signal when the bearer (14) of the primary
electronic tag (12) is not authorised to remove the
valuable item (18) from the zone.

15 6. A system (10) as claimed in Claim 4 or Claim 5,
characterized in that it includes an access control
arrangement (24) responsive to the control signal and
operable selectively to inhibit departure of the
20 person (14) from the zone if the valuable item (18) is
not included in the inventory.

7. A system (10) as claimed in Claim 2,
characterized in that the primary electronic tag (12)
25 includes primary attachment means configured
releasably to attach it to the primary bearer (14)
which is in the form of a person and the secondary
electronic tag (16) includes secondary attachment
means configured releasably to attach it to the
30 secondary bearer (18) which is also in the form
a person.

8. A system (10) as claimed in Claim 7,
characterized in that the secondary identification
35 data identifies a child under the supervision of the
bearer (14) of the primary electronic tag (12) and the
comparator (26) generates an output signal in the form

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of an alarm signal when the primary and secondary electronic tags (12, 16) are not within a predetermined zone covered by the reading apparatus (20).

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9. A system (10) as claimed in Claim 8, characterized in that it includes a plurality of reading apparatus (20) each covering a different predetermined zone forming part of a public area, the
10 comparator means (26) being operable to process the primary identification data and verify that all secondary electronic tags (16) identified by the primary identification data are located within the predetermined zone covered by associated reading
15 apparatus (20) failing which an output signal in the form of an alarm signal is generated.

10. A system (10) as claimed in Claim 1 or Claim 2, characterized in that the primary electronic tag (12)
20 is issued in use to a person (14) authorised to use at least one selected vehicle (18) and the secondary electronic tag (16) is uniquely associated with and attached in use to the selected vehicle (18), the output signal indicating if the person (14) is
25 authorised to use the vehicle (18).

11. A system (10) as claimed in Claim 10, characterized in that it includes disabling means (34) responsive to the output signal and connected in use
30 to an electrical system of the vehicle (18) and operable selectively to disable the vehicle.

12. A system (10) as claimed in any one of the preceding claims, characterized in that the primary
35 and secondary electronic tags (12, 16) are active tags including an RF transmitter for intermittently transmitting the identification data.

13. A system (10) as claimed in any one of the preceding claims, characterized in that the primary and secondary electronic tags (12, 16) are programmed with the primary and secondary identification data in a wireless fashion.

14. A system (10) as claimed in any one of the preceding claims, characterized in that at least the secondary electronic tag (16) includes tamper detection means for detecting tampering with the tag (16).

15. A method of monitoring movement from a selected zone which is monitored by reading apparatus, the method characterized in that it includes

reading primary identification data from a primary electronic tag (12) issued to a primary bearer (14) of the primary electronic tag (12);

reading secondary identification data from a secondary electronic tag (16) associated with a secondary bearer (18) of the secondary electronic tag (16), the secondary identification data being associated with the primary identification data which defines authorised movement of the secondary bearer; and

comparing the secondary identification data and the primary identification data read by the reader thereby to monitor movement of the secondary bearer (18) from the selected zone.

16. A method as claimed in Claim 15, characterized in that it includes fixedly attaching the secondary electronic tag (16) to an item of value (18) thereby to monitor unauthorised removal of the item of value (18) from the selected zone.

17. A method as claimed in Claim 15, characterized in that it includes

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issuing the primary electronic tag (12) to a person (14) supervising at least one child (18);

issuing a secondary electronic tag (16) to the child (18), the secondary electronic tag (16)

5 including unique identification data to identify the child (18) and which is intermittently transmitted;

programming the primary electronic tag (12) with the primary identification data and the secondary electronic tag (16) with the secondary identification data; and

generating an alarm signal when the child (18) and the supervisor (14) are not in the same zone.

18. A method as claimed in Claim 17, characterized in that a plurality of children (18) are each issued with a secondary electronic tag (16) and the primary identification data includes an inventory of the secondary electronic tags (16) with which it is associated.

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19. A method as claimed in any one of the preceding claims 15 to 18 inclusive, characterized in that it includes controlling operation an access control arrangement (24) in response to the comparison selectively to inhibit departure of the primary and/or secondary bearer (14, 16) from the zone.

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20. A method of monitoring the use of at least one vehicle (18), characterized in that the method includes

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issuing a primary electronic tag (12) including primary identification data to a person (14) authorised to drive a particular vehicle (18);

providing the vehicle (18) with reading apparatus and a secondary electronic tag (16) which includes secondary identification data associated with the primary identification data;

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reading the primary and secondary identification data in a wireless fashion when the person (14) occupies the vehicle by means of the reading apparatus; and

comparing the primary and secondary identification data read by the reader thereby to monitor use of the vehicle (18).