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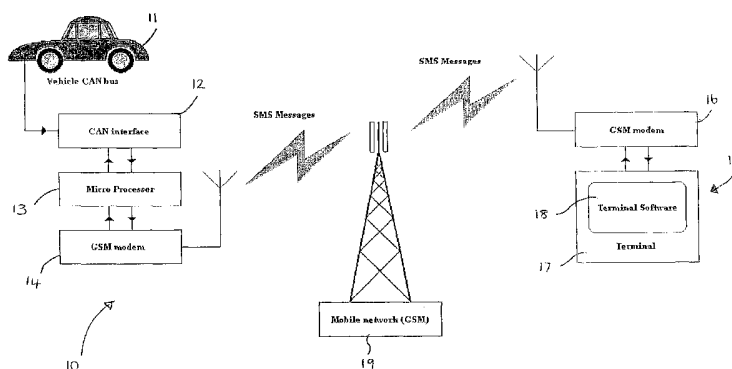
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(54) Title: APPARATUS AND METHOD FOR MONITORING THE USAGE STATUS OF AN ASSET



(57) Abstract: Apparatus (10) for monitoring the usage status of an asset (11) (as defined herein) including a data transfer assembly, comprises: an interface (12), for connection to a said data transfer assembly, that is capable of accepting data from the said assembly; a programmable first processor device (13) for processing data accepted via the interface; and a first transmitter (14) for transmitting data processed by the first processor device (13), the interface, the first processor device and the transmitter being operatively connected together. The apparatus (10) also includes, located remotely from the first transmitter, a first receiver (16) of data transmitted by the first transmitter; and operatively connected thereto a programmable, further processor device (17) for processing data received by the first receiver and operatively connected to a display (18) for displaying data processed by the further processor device (17). The first processor device (13) is programmed to convert the data accepted via the interface (12) into a "short message system" (SMS) format; and the further processor device (17) is programmed to convert SMS data received by the first receiver (16) to a format suitable for display via the display device (18); and/or to generate one or more messages, that are displayable via the display device (18), in dependence on the content of the SMS data. The apparatus permits economical monitoring of usage statuses, using a low bandwidth transmission method.

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APPARATUS AND METHOD FOR MONITORING THE USAGE STATUS  
OF AN ASSET

5 This invention relates to apparatus and a method for monitoring the usage status of an asset.

As defined herein, and in the art generally, "asset" means any of a wide range of apparatuses, vehicles and items of equipment that are useable in various activities, including for purposes of transportation and in industrial processes.

10

Examples of assets therefore include but are not limited to motor vehicles such as cars, trucks, excavators, tractors and combine harvesters; railway locomotives and wagons; boats and ships; process plant; factory vehicles such as stacker trucks; aircraft - such as helicopters and fixed wing aircraft; and indeed virtually any item  
15 of equipment the usage of which causes deterioration, over time, of its condition.

The invention is described herein with particular reference to an asset in the form of a motor vehicle such as a car, van or truck. However, the invention is equally applicable in relation to any of the types of asset identified hereinabove.

20

Many assets are moveable, from place to place, during use.

The owner or another party having responsibility for the asset is often prevented, by reason of such movement, from knowing the precise location of the asset at a  
25 given time.

For this reason various so-called "asset tracking" apparatuses and methods have become known in the art.

30 Such apparatuses typically include small transponders that are secured to moveable assets, so that the assets may effectively transmit data, to a host station, concerning their locations.

Although such tracking apparatuses are of some utility, in general they do not seek to establish the usage status of an asset.

Moreover, asset tracking apparatuses generally operate over comparatively short  
5 distances, for example for the tracking of self-powered vehicles within a factory or warehouse environment. Over such distances it is possible to use comparatively sophisticated communication languages that rely on high bandwidth transmission protocols.

10 However, such apparatuses are not suitable for use in conjunction with assets whose movements may be measured in tens or hundreds of kilometres. Examples of such assets include leased or rented vehicle fleets such as motor cars and vans; construction site vehicles such as excavators, dump trucks and tipper trucks; and agricultural vehicles such as tractors and harvesting machines. In such vehicles  
15 the use of high bandwidth transmission apparatuses may be prohibitively expensive and/or give rise to excessive power consumption requirements.

One particular problem which presents itself to owners and managers of leased /  
rented vehicle fleets is that the users of the vehicles commonly fail to observe  
20 correctly the manufacturers' servicing schedules.

As a result there are repeated, persistent failures to have the vehicles serviced at the correct intervals. This causes an unnecessary reduction in the value of the assets represented by the vehicles. This is undesirable for the owners of the  
25 vehicles.

Failure correctly to observe a recommended maintenance or servicing schedule may also invalidate a manufacturer's warranty with the results that the owner's asset value is further reduced; and that any repairs that become necessary are the  
30 financial responsibility of the fleet owner and not of the manufacturer.

It follows from the foregoing that there is a general need for an apparatus and method that not only provide data on the extent of usage of an asset that is located

remotely from an owner's premises; but also that do so using economical communications protocols.

According to a first aspect of the invention there is provided apparatus for  
5 monitoring the usage status of an asset (as defined herein) including a data transfer assembly, the apparatus comprising:

an interface, for connection to a said data transfer assembly, that is capable of accepting data from the said assembly;

10 a programmable first processor device for processing data accepted via the interface;

a first transmitter for transmitting data processed by the processor device, the interface, the first processor device and the transmitter being operatively connected together; and

15 located remotely from the first transmitter, a first receiver of data transmitted by the first transmitter; and operatively connected thereto a programmable, further processor device for processing data received by the first receiver and operatively connected to a display for displaying data processed by the further processor device, wherein the first processor device is programmed to convert the data accepted via the interface into a "short message system" (SMS)  
20 format; and wherein the further processor device is programmed to convert SMS data received by the first receiver to a format suitable for display via the display device; and/or to generate one or more messages, that are displayable via the display device, in dependence on the content of the SMS data.

25 The use of an SMS format for signals containing data indicative of the usage status of an asset advantageously permits the transmission of such data using a mobile telephone network.

The costs to users of such networks have fallen dramatically since their  
30 introduction, especially when the networks are used for the transmission of SMS messages (as compared with voice calls). The power consumption requirements of devices that communicate via mobile telephone networks are generally low.

Preferably the interface accepts data from a said data transfer assembly in the form of a CAN-BUS.

As is well known, a CAN-BUS is a data transfer apparatus that is of very  
5 considerable utility in the electronic control of vehicles, process plant and similar apparatuses.

A typical CAN-BUS includes a ring circuit via which a stream of data is transmitted in serial fashion. The CAN-BUS includes a plurality of nodes at  
10 which devices may be operatively connected, for receiving data in the form of commands; and transmitting data pertaining to their operational statuses. It would be a convenient exercise to modify the CAN-BUS of a motor vehicle such as a car or a truck to incorporate at a node a connection to an interface forming part of the apparatus of the invention.

15

By "connection" is meant any operable way of connecting to the CAN-BUS node, including hard wired connections; wireless connections and releasably securable connector plugs.

20 Conveniently the first processor device of the invention includes or is operatively connected to a memory device that is capable of storing data accepted via the interface.

The presence of a memory device allows the temporary or permanent storing of  
25 data, thereby permitting intermittent transmission of data from the asset to a remote location and consequently avoiding the need for continuous data transmission from the location of the asset.

Conveniently the apparatus also includes a connector for connecting the interface  
30 to a said data transfer assembly.

Such a connector may typically be of a type well known in the CAN-BUS art.

Conveniently the first processor device is programmed to cause transmission via the first transmitter of one or more signals when data accepted via the interface from a said data transfer assembly signifies a pre-defined usage status of a said asset.

5

This feature of the invention allows the setting, in the first processor device, of threshold usage status values corresponding to recommended maintenance or service intervals.

10 When, as is preferably the case, the data signifying a predetermined usage status includes:

(i) that a pre-defined action is needed; and/or

(ii) that a pre-defined quantum of usage of a said asset remains before a service operation becomes desirable; and/or

15 (iii) that the scheduled time for a service operation has passed; and/or

(iv) that the asset has achieved a predetermined amount of usage, regardless of a need for servicing,

the apparatus of the invention conveniently permits the generation of warnings of impending service requirements; of the passing of a service point  
20 without the user arranging a service operation; and/or the usage of the asset exceeding a value corresponding for example to a manufacturer's warranty limit.

More specifically, the interface preferably is connectable to a said data transfer assembly of a wheeled vehicle including an odometer an instantaneously  
25 prevailing reading of which is transferred at least intermittently via the data transfer assembly, wherein the said data signifying the usage statuses (i) - (iv) includes data pertaining to a said instantaneously prevailing odometer reading transferred via the said transfer assembly.

30 All motor vehicles used legally on public roads include odometers for recording the total distances travelled. Since vehicle manufacturers relate the recommended service schedules of the vehicles they supply to odometer readings, it is particularly convenient to use an odometer reading as the basis for establishing

whether a service operation is imminently due or is overdue; or whether a warranty usage limit has been exceeded.

5 However, other assets such as agricultural vehicles, construction site equipment, boats and aircraft include recorders for recording the number of hours of use that the assets have experienced. As an alternative to the use of odometer readings, therefore, other usage data such as but not limited to usage time records are suitable as data for use in the apparatus of the invention.

10 In a preferred embodiment of the apparatus the first processing device is programmed to compare the data pertaining to the instantaneously prevailing odometer reading to one or more predetermined odometer readings pertaining to a need for a service operation; and, in dependence on the outcome of the comparison, generate one or more said predetermined signals.

15 The predetermined odometer readings may advantageously be pre-programmed into the first processor device. Alternatively they may be updated remotely, according to apparatuses and methods defined hereinbelow.

20 The latter possibility is advantageous for example in the event of an asset manufacturer issuing altered service interval recommendations part-way through the service life of an asset.

25 Conveniently the first processor device generates the or each signal as a coded SMS message indicative of a usage status as described herein. More preferably each said coded SMS message contains data in the form of one or more fields of hexadecimal code.

30 This is of benefit because the maximum length of an SMS message is 160 characters. Through the use of hexadecimal code it is possible to transmit meaningful amounts of information using the SMS protocol, despite the short message length available.

Even more preferably the or each signal contains data identifying the asset and data indicative of the status of one or more registers of the first processor device.

The transmission of data in this *per se* known format is advantageously efficient.

5

Additionally or alternatively, the or each said signal may optionally include data indicating one or more of:

- (a) the identity of a said asset;
- (b) the aggregate usage of the asset;
- 10 (c) the owner of the asset;
- (d) the user of the asset;
- (e) a description of the asset;
- (f) data numbers relating to the asset and/or a host represented by the receiver;
- 15 (g) the activation of one or more condition warning devices of the asset;
- (h) the extent of usage of ancillary parts of the asset;
- (i) the duration of use of the asset;
- (j) the relative amounts of usage time and non-usage time of the asset;
- 20 (k) whether the usage of the device exceeds predetermined or manufacturer-specified recommendations;
- (l) the location of the asset; and/or
- (m) the usage of the vehicle over a period preceding a malfunction or accident.

25

Preferably the transmitter and the receiver each are or include a GSM modem.

This *per se* known device permits two-way data communication via a mobile telephone network. Therefore it is ideally suited to use in the invention.

30

Preferably the receiver and/or the further processor and/or the display device are constituted as parts of a personal computer, a server network or a mainframe

computer. These features render the components of the invention that are located remotely from the asset suitable for incorporation in a call or data centre.

Preferably the further processor device includes programmed therein software

5 including:

- a graphical user interface (GUI) application;
- a database; and
- an SMS server.

10 Moreover, the further processor device preferably is operatively associated with a transmitter (such as but not limited to the GSM modem defined hereinabove) and the graphical user interface application includes user input functions permitting one or more of:

- the addition of an asset;
- 15 • alteration of the recorded details of an asset;
- deletion of an asset;
- display of the recorded details pertaining to an asset;
- the generation and sending via the transmitter of a request for data from the first processor device;
- 20 • the generation and sending via the transmitter of one or more messages, to the first processor device, causing configuration of one or more registers in the first processor device.

These features of the apparatus of the invention permit intervention in order to  
25 alter data and generate commands pertaining to a particular asset. Such data and commands may then readily be transmitted via the GSM modem or other further transmitter device forming part of the apparatus, preferably using further features of the apparatus as described herein.

30 Conveniently the GUI application generates one or more messages, for display via the display device, in dependence on signals received from the first processor device.

Thus the GUI application may conveniently generate to eg. an operator at a data centre a warning signal that a particular asset is approaching or has exceeded a recommended service point.

- 5 Preferably the database includes data pertaining to one or more of:
- the identity of a said asset;
  - the identity of the owner or user of a said asset;
  - a description of a said asset;
  - a data number indicative of a GSM modem secured to a said asset;
  - 10 • a "host" data number indicative of a GSM modem operatively associated with the database, the said data number being associated with a said asset;
  - data indicative of the usage status of a said asset.

- 15 The respective data numbers stored in the database preferably each are or include a mobile telephone number.

The advantage of including such a number in the data number of the asset and the components located remotely therefrom is that it is then readily possible to  
20 allocate unique identifying numbers to an asset and to eg. a partition of a server in a remote data centre, in a form that is easily processed in a mobile telephone network.

On the other hand, it is generally desirable to contain to a reasonable degree the  
25 quantity of data requiring processing and transmission via the apparatus of the invention.

Conveniently the SMS server therefore includes software for carrying out one or more of:

- 30 monitoring the receiver and conditioning signals received thereby;  
transferring data contained therein to the database; and/or  
conditioning commands generated by the GUI application for  
transmission.

It is also preferable that the apparatus of the invention includes a receiver operatively associated with the first processor device; and that when the GUI application generates one or more conditioning commands causing configuration  
5 of one or more registers in the first processor device such commands may include data for altering, in the first processor device, one or more of:

- a host data number;
- a usage status of a said asset indicative of an impending need for a service operation;
- 10 • a usage status of a said asset indicative of passing of a scheduled time for a service operation; and/or
- a predetermined usage status that is regardless of a need for servicing.

15 Thus it is possible using the apparatus of the invention remotely to update the first processor device, for example following successful completion of a service operation (so that warning messages are not generated erroneously) and/or to alter for example the service interval of an asset, based on updating information received from a manufacturer.

20 Furthermore, it is possible using the SMS server as defined herein to alter for example the host data number that the GSM modem (when present) must dial in order to access the correct host partition for the asset to which it is secured.

25 Conveniently the apparatus includes a common support structure to which are secured the interface, the first processor device and the first transmitter.

The invention also resides in a motor vehicle including a CAN-BUS having operatively connected thereto the interface of an apparatus as defined herein. The  
30 invention additionally extends to the use of such an apparatus in monitoring of the usage status of an asset.

According to a further aspect of the invention there is provided a method of monitoring the usage status of an asset (as defined herein) including a data transfer assembly, the method comprising:

5 via an interface operatively connected thereto, accepting data indicative of a usage status from a said data transfer assembly;

processing the said data, using a programmable first processor device, whereby to convert it to SMS format;

transmitting the thus converted data via a first transmitter to a first receiver located remotely therefrom;

10 processing SMS data received by the receiver using a further programmable processor device to convert the said SMS data to a format suitable for display via a display device; and/or

generating one or more messages, that are displayable via the display device, in dependence on the content of the said SMS data received by the receiver.

Further, optional aspects of the method of the invention are defined in the claims depending from Claim 26.

20 There now follows a description of preferred embodiments of the invention, by way of non-limiting example, with reference being made to the accompanying drawings in which:

Figure 1 is a schematic overview of apparatus according to the invention plus certain components of a mobile telephone network not forming part of the invention *per se*;

Figure 2 is a flow chart showing in exemplary fashion the processing of messages generated by a first processor according to the invention;

Figure 3 shows in similar fashion the manner in which a said first processor responds to configuration commands received from a further processor device also forming part of the invention; and

30 Figure 4 shows exemplary outputs, via a display forming part of the apparatus of the invention, generated by a graphical user interface application also forming part of the invention.

Referring to the drawings, apparatus 10 for monitoring the usage status of an asset 11 (which in the example shown is a motor car) that includes a data transfer assembly comprises, firstly, an interface 12 for connection to the data transfer assembly of the asset.  
5

If, as in the case of the illustrated example, the asset 11 is a vehicle including a CAN-BUS, the interface 12 is a CAN-BUS interface device including (as needed) connectors and other components for permitting the interface to accept data that is transferred via the CAN-BUS.  
10

The apparatus 10 also includes a programmable first processor device 13 for processing data accepted via the interface; and a first transmitter 14 that in the embodiment shown is a GSM modem.  
15

The interface 12, first processor device 13 and first transmitter 14 are operatively connected together, preferably by way of being hard-wired within a common housing that acts as a support structure for the aforesaid components. Alternatively, however, the interface 12, first processor device 13 and first transmitter 14 may if desired be distributed about the asset 10. Thus, for example, the first transmitter 14 may be located so as to maximise the efficiency of data transmission.  
20

Moreover it is not essential that the aforementioned components are hard-wired together. Various wireless communication protocols are applicable to the aforementioned components.  
25

The first processor device processes data accepted from the data transfer assembly via the interface. The first transmitter transmits such data, following processing by the first processor device.  
30

At a location that is remote from the asset 11 and hence from the first transmitter 14, the apparatus of the invention further includes a first receiver 16 of data transmitted by the first transmitter 14.

5 Operatively connected to first receiver 16 are a programmable, further processor device 17; and a display device 18. The display device displays data, related to that received by the first receiver, that has undergone processing in the further processor device.

10 The first processor device 13 is programmed to convert the data accepted via the interface 12 to an SMS format. The further processor device 17 is programmed to convert SMS data received by the first receiver 16 to a format suitable for display via the display device 18; and to generate one or more messages that are displayable via the display device 18, in dependence on the content of the SMS  
15 data.

The first processor device 13 may include a memory device (not shown in the drawings) that is capable of storing data accepted via the interface.

20 When present, the memory device obviates the need for continuous transmission of data from the location of the asset to the first receiver. Instead it permits intermittent transmission of data bursts that may be contained within discrete data calls made via a mobile telephone network.

25 The first processor device 13 is additionally programmed to cause transmission via the first transmitter 14 of one or more signals when data accepted via the interface 12 from the data transfer assembly of the asset 11 signifies a predefined usage status of the asset 11.

30 Such data may include:

- (i) that a pre-defined action is needed; and/or
- (ii) that a pre-defined quantum of usage of a said asset remains before a service operation becomes desirable; and/or

- (iii) that the scheduled time for a service operation has passed; and/or
- (iv) that the asset has achieved a predetermined amount of usage, regardless of a need for servicing.

5 Typically, in the case of a motor vehicle 11, such data would be based on an instantaneously prevailing odometer reading transferred at least intermittently via the data transfer assembly (CAN-BUS) of the vehicle 11.

10 The first processor device 13 operates by comparing such instantaneously prevailing data (whether derived from an odometer reading or another cumulative indicator of usage) with one or more predetermined values pertaining to a need for a service operation. In dependence on the outcome of the comparison the first processor device generates one or more predetermined signals for transmission by the first transmitter 14.

15

The data are transmitted in the form of hexadecimal code. Since the maximum length of an SMS message is 160 characters, the use of hexadecimal code for conveying the data in the messages advantageously ensures that the data can be contained within the message format.

20

As noted herein, the four primary fields are those indicating:

- (i) that a pre-defined action is needed; and/or
- (ii) that a pre-defined quantum of usage of a said asset remains before a service operation becomes desirable; and/or
- 25 (iii) that the scheduled time for a service operation has passed; and/or
- (iv) that the asset has achieved a predetermined amount of usage, regardless of a need for servicing.

30

These correspond to the following messages:

*MSGID=0x01 Service Due Message*

This message will be sent from the remote unit to the host when the service odometer reaches 0 (zero) for the first time, to indicate that a service is due. A flag

will be raised within the remote processor to prevent repeated sending of this message in the case of a variable service reading.

**MSGID=0x02**                      *Pre-Service Warning*

5 This message will be sent from the remote unit to the host when the service odometer reaches *n* miles/kilometres prior to the service odometer reading, to indicate that a service is imminently due. A flag will be raised within the remote processor to prevent repeated sending of this message in the case of a variable service reading.

10 \* This message will be suppressed if the PRESSER setting (see below) is set to zero during the configuration process.

**MSGID=0x03**                      *Post-Service Warning*

15 This message will be sent from the remote unit to the host when the service odometer reaches *n* miles/kilometres greater than the service odometer reading, to indicate that a service is overdue. A flag will be raised within the remote processor to prevent repeated sending of this message in the case of a variable service reading.

20 \* This message will be suppressed if the POSSER setting (see below) is set to zero during the configuration process.

**MSGID=0x04**                      *Warning ODO reached*

25 This message will be sent from the remote unit to the host when the current odometer is equal to the warning odometer setting, to indicate that a pre-defined mileage has been reached.

\* This message will be suppressed if the WODO setting (see below) is set to zero during the configuration process.

A further message type is as follows:

30

**MSGID=0xF0**                      *Configuration broadcast message*

This message will be sent from the remote unit to the host to confirm receipt of a configuration message and to update the host with information which is not sent

during configuration, such as current odometer reading (CODO) and service odometer reading (SODO), since these are predefined by the vehicle and the person responsible for conducting the service.

- \* This message will also be sent as a reply to a Poll Request (POR), which can be sent by the host in order to update the PC based software with current vehicle settings.

When configured in hexadecimal, as SMS messages, the data fields transmitted under varying conditions are as follows:

10

<b>VID=0..FFFFFF</b>	<b>Vehicle ID</b>
<b>MSGID=0x01</b>	<b>Service Due Message</b>
<b>CODO=0..FFFFFFF</b>	<b>Current ODO</b>
<b>SODO=0..FFFF</b>	<b>Should show 0 (Zero) for this record</b>
<b>WODO=0.. FFFFFFFF</b>	<b>Pre-configured warning ODO (Zero if not used)</b>
<b>PRESER=0..FFFF</b>	<b>Warn this many miles before service(Zero if not used)</b>
<b>POSSER=0..FFFF</b>	<b>Warn this many miles after service(Zero if not used)</b>

20

<b>VID=0..FFFFFF</b>	<b>Vehicle ID</b>
<b>MSGID=0x02</b>	<b>Pre-Service Warning</b>
<b>CODO=0..FFFFFFF</b>	<b>Current ODO</b>
<b>SODO=0..FFFF</b>	<b>Next service ODO</b>
<b>WODO=0.. FFFFFFFF</b>	<b>Pre-configured warning ODO (Zero if not used)</b>
<b>PRESER=0..FFFF</b>	<b>Warn this many miles before service(Zero if not used)</b>
<b>POSSER=0..FFFF</b>	<b>Warn this many miles after service(Zero if not used)</b>

30

<b>VID=0..FFFFFF</b>	<b>Vehicle ID</b>
<b>MSGID=0x03</b>	<b>Post-Service Warning</b>
<b>CODO=0..FFFFFFF</b>	<b>Current ODO</b>
<b>SODO=0..FFFF</b>	<b>Next service ODO</b>
<b>WODO=0.. FFFFFFFF</b>	<b>Pre-configured warning ODO (Zero if not used)</b>
<b>PRESER=0..FFFF</b>	<b>Warn this many miles before service(Zero if not used)</b>
<b>POSSER=0..FFFF</b>	<b>Warn this many miles after service(Zero if not used)</b>

40

<b>VID=0..FFFFFF</b>	<b>Vehicle ID</b>
<b>MSGID=0x04</b>	<b>Warning ODO reached</b>
<b>CODO=0..FFFFFFF</b>	<b>Current ODO</b>
<b>SODO=0..FFFF</b>	<b>Next service ODO</b>

	<b>WODO=0..FFFFFFFF</b>	<b>Pre-configured warning ODO (Zero if not used)</b>
	<b>PRESER=0..FFFF</b>	<b>Warn this many miles before service(Zero if not used)</b>
5	<b>POSSER=0..FFFF</b>	<b>Warn this many miles after service(Zero if not used)</b>
	<b>VID=0..FFFFFF</b>	<b>Vehicle ID</b>
	<b>MSGID=0xF0</b>	<b>Configuration broadcast message</b>
	<b>CODO=0..FFFFFFFF</b>	<b>Current ODO</b>
10	<b>SODO=0..FFFF</b>	<b>Next service ODO</b>
	<b>WODO=0..FFFFFFFF</b>	<b>Pre-configured warning ODO (Zero if not used)</b>
	<b>PRESER=0..FFFF</b>	<b>Warn this many miles before service(Zero if not used)</b>
15	<b>POSSER=0..FFFF</b>	<b>Warn this many miles after service(Zero if not used)</b>
	<b>HOST=+447971246514</b>	<b>Host telephone number</b>

Note that using hexadecimal the vehicle identification field can take any numerical value between 0 and 16777215.

The current odometer field (CODO), being represented by 8 hexadecimal bits may take any value between 0 and 4294967295. Thus the apparatus of the invention may monitor the usage of an asset for over 4 billion usage units (regardless of whether usage is measured in miles, kilometres, hours or other units).

The coding of the data intercepted from the data transfer assembly occurs in the first processor. The first processor also causes the transmission of the thus-coded data via the first transmitter.

Although as presently configured the data fields of the invention are as outlined hereinabove, further data fields are possible. These include but are not limited to:

- (a) the identity of a said asset;
- (b) the aggregate usage of the asset;
- (c) the owner of the asset;
- (d) the user of the asset;
- (e) a description of the asset;
- (f) data numbers relating to the asset and/or a host represented by the receiver;

- (g) the activation of one or more condition warning devices of the asset;
- (h) the extent of usage of ancillary parts of the asset;
- (i) the duration of use of the asset;
- 5 (j) the relative amounts of usage time and non-usage time of the asset;
- (k) whether the usage of the device exceeds predetermined or manufacturer-specified recommendations;
- (l) the location of the asset; and/or
- (m) the usage of the vehicle over a period preceding a malfunction or  
10 accident.

As signified by the transmission tower 19 in Figure 1 conveniently the transmission of the SMS messages take place via a mobile telephone network.

- 15 More specifically, the first transmitter and the first receiver are GSM modem devices such as but not limited to the Siemens TC35 GSM modem board.

Other kinds of transmitters and receivers are viable within the scope of the invention.

- 20 One additional advantage of using transmitters and receivers that communicate via a mobile telephone network, however, is that it is relatively easy to establish when an asset such as a motor vehicle is removed from the country in which it is intended to operate. This can in turn allow eg. the re-calculation of insurance rates  
25 or eg. provide evidence that costs arising from use of the vehicle outside its intended territory are the responsibility of the user.

- The preferred device constituting the first processor 13 is a PIC processor such as but not limited to the 16F876A processor. PIC processors are manufactured by  
30 Microchip Corporation. They are well known for being versatile, cheap and easy to programme.

The PIC device typically requires a power supply to operate. Such a power supply may be provided as part of the apparatus of the invention, or may be a pre-existing component of the asset with which the apparatus of the invention is used.

5 Other forms of processor are possible within the scope of the invention.

The first receiver 16, the further processor 17 and the display device 18 preferably are constituted as parts of personal computer, a server network and/or a mainframe computer, at a location remote from that in which the asset 11 operates.

10

The further processor device 17 includes programmed therein software including:

- a graphical user interface (GUI) application;
- a database; and
- an SMS server.

15

The GUI application includes user input functions permitting one or more of:

- the addition of an asset;
- alteration of the recorded details of an asset;
- deletion of an asset;
- 20 • display of the recorded details pertaining to an asset;
- the generation and sending via the transmitter of a request for data from the first processor device.

Figure 4 shows examples of the data fields that may be altered using the GUI  
25 interface, when the apparatus is configured to monitor the usage status of a motor vehicle. The relevant data are shown in the window 21 visible in Figure 4.

The GUI application also is capable of generating one or more message for display via the display device, in dependence on signals received from the first  
30 processor device.

In the example of Figure 4 the output window 22 shows that the vehicle whose details are visible in window 21 has attained the odometer reading corresponding

to a service point. This is the result of the first processor 13 that is secured to the vehicle in question generating the MSGID message "Service due" identified above, and arranging for its transmission to the first receiver via the mobile telephone network from the first transmitter 14.

5

The software embodied in the further processor device 17 also includes a database containing data pertaining to one or more of:

- the identity of a said asset;
- the identity of the owner or user of a said asset;
- 10 • a description of a said asset;
- a data number indicative of a GSM modem secured to a said asset;
- a "host" data number indicative of a GSM modem operatively associated with the database, the said data number being associated with a said asset;
- 15 • data indicative of the usage status of a said asset.

As is evident from window 21 of Figure 4, the data numbers of the asset and the host preferably are mobile telephone numbers, which are readily programmed (through the generation of appropriate commands in the first and further  
20 processors (13, 17)).

The software programmed into the further processor 17 also includes an SMS server which provides two-way communication between the asset-located components of the invention and those sited at a remote location. The SMS server  
25 software continuously monitors the first transmitter 14 and the first receiver 16 for incoming messages. It processes the messages as received and passes the data obtained therefrom to the aforementioned database. The SMS server additionally conditions messages generated by the further processor, for transmission via a further transmitter associated with the further processor device 17.

30

If as in the preferred embodiment the first receiver 16 is configured as a GSM modem, this device inherently provides the functions of the further transmitter.

Similarly, since the first transmitter 14 also preferably is configured as a GSM modem, it inherently includes a further receiver that is capable of receiving messages generated by the further processor 17 and transmitted by the further transmitter. This aspect is important, since it is from time to time desirable to  
5 transmit configuration messages (an example of which appears as "Configuration broadcast message" hereinabove) to a first processor 13 secured to an asset 11.

Such configuration messages may, for example, cause re-setting of the indicator flags warning that service points are due, imminently due or exceeded. Such an  
10 action may be desirable following servicing of a vehicle.

Similarly the configuration commands transmitted in this fashion may alter the pre-defined points in the usage of the asset at which certain messages become generated. This may be desirable for example in the event of a manufacturer  
15 changing the recommended service interval of an asset 11 part-way through its service life.

Configuration commands of this kind may also simply acknowledge receipt from the first processor 13 of the various warning messages described hereinabove.  
20 This may be desirable to avoid overloading the further processor 17 with repetitious warnings and alerts. It should in practice be adequate for any given warning to be transmitted once, and for a configuration command subsequently to clear the warning flag in the first processor following carrying out of a service action.

25 The first processor device may also send messages of any of the aforementioned types, by way of confirmation of receipt of messages from the host server or similar device constituting the further processor device.

30 The SMS server may in addition contain communications error handling and correction routines. Such routines are represented in window 23 of Figure 4.

In use of apparatus according to the invention, the interface 12 may periodically or continuously intercept relevant data from the data stream passing around the data transmission assembly of the asset 11. The processing philosophy of the first processor, following receipt of such data, is shown in Figure 2 in flow chart form.

5 The flow chart of Figure 2 concerns, specifically, the apparatus of the invention when configured to monitor the service usage of a motor vehicle. The data and method steps in Figure 2 are self-explanatory.

Figure 3 shows in a similar manner the way in which the first processor 13 of the  
10 apparatus of the invention processes incoming messages from the further processor 17 transmitted via the GSM modem represented by first receiver 16 of Figure 1. As is evident from Figure 3 these steps result in re-setting of the parameters to which the first processor works, thereby altering the pre-defined usage thresholds at which subsequent warning messages are generated.

15

CLAIMS

1. Apparatus for monitoring the usage status of an asset (as defined herein) including a data transfer assembly, the apparatus comprising:
- 5           an interface, for connection to a said data transfer assembly, that is capable of accepting data from the said assembly;
- a programmable first processor device for processing data accepted via the interface;
- a first transmitter for transmitting data processed by the first processor
- 10       device, the interface, the first processor device and the transmitter being operatively connected together; and
- located remotely from the first transmitter, a first receiver of data transmitted by the first transmitter; and operatively connected thereto a programmable, further processor device for processing data received by the first
- 15       receiver and operatively connected to a display for displaying data processed by the further processor device, wherein the first processor device is programmed to convert the data accepted via the interface into a "short message system" (SMS) format; and wherein the further processor device is programmed to convert SMS data received by the first receiver to a format suitable for display via the display
- 20       device; and/or to generate one or more messages, that are displayable via the display device, in dependence on the content of the SMS data.
2. Apparatus according to Claim 1 wherein the interface accepts data from a said data transfer assembly in the form of a CAN-BUS.
- 25
3. Apparatus according to Claim 1 wherein the first processor device includes or is operatively connected to a memory device that is capable of storing data accepted via the interface.
- 30
4. Apparatus according to any preceding claim including a connector for connecting the interface to a said data transfer assembly.

5. Apparatus according to any preceding claim wherein the first processor device is programmed to cause transmission via the first transmitter of one or more signals when data accepted via the interface from a said data transfer assembly signifies a pre-defined usage status of a said asset.
- 5
6. Apparatus according to Claim 5 wherein the data signifying a predetermined usage status includes:
- (i) that a pre-defined action is needed; and/or
  - (ii) that a pre-defined quantum of usage of a said asset remains before a service operation becomes desirable; and/or
  - 10 (iii) that the scheduled time for a service operation has passed; and/or
  - (iv) that the asset has achieved a predetermined amount of usage, regardless of a need for servicing.
- 15 7. Apparatus according to Claim 6 wherein the interface is connectable to a said data transfer assembly of a wheeled vehicle including an odometer an instantaneously prevailing reading of which is transferred at least intermittently via the data transfer assembly, wherein the said data signifying the usage statuses (i) - (iv) includes data pertaining to a said instantaneously prevailing odometer reading transferred via the said transfer assembly.
- 20
8. Apparatus according to Claims 5, 6 and 7 wherein the first processor device is programmed to compare the data pertaining to the instantaneously prevailing odometer reading to one or more predetermined odometer readings pertaining to a need for a service operation; and, in dependence on the outcome of the comparison, generate one or more said predetermined signals.
- 25
9. Apparatus according to Claim 5 or any preceding claim depending therefrom, wherein the first processor device generates the or each signal as a coded SMS message indicative of a said usage status.
- 30
10. Apparatus according to Claim 9 wherein each said coded SMS message contains data in the form of one or more fields of hexadecimal code.

11. Apparatus according to Claim 9 or Claim 10 wherein the or each signal contains data identifying the asset and data indicative of the status of one or more registers of the first processor device.

5

12. Apparatus according to Claim 5 or any preceding claim depending therefrom, wherein the or each signal includes data indicating one or more of:

- (a) the identity of a said asset;
- (b) the aggregate usage of the asset;
- 10 (c) the owner of the asset;
- (d) the user of the asset;
- (e) a description of the asset;
- (f) data numbers relating to the asset and/or a host represented by the receiver;
- 15 (g) the activation of one or more condition warning devices of the asset;
- (h) the extent of usage of ancillary parts of the asset;
- (i) the duration of use of the asset;
- (j) the relative amounts of usage time and non-usage time of the asset;
- 20 (k) whether the usage of the device exceeds predetermined or manufacturer-specified recommendations;
- (l) the location of the asset; and/or
- (m) the usage of the vehicle over a period preceding a malfunction or accident.

25

13. Apparatus according to any preceding claim wherein the transmitter is or includes a GSM modem, whereby the signals are transmissible and receivable via a mobile telephone network.

30 14. Apparatus according to any preceding claim wherein the receiver of data is or includes a GSM modem, whereby the signals are transmissible and receivable via a mobile telephone network.

15. Apparatus according to any preceding claim wherein the first receiver, and/or the further processor and/or the display device are constituted as parts of a personal computer, a server network or a mainframe computer.

5 16. Apparatus according to any preceding claim wherein the further processor device includes programmed therein software including:

- a graphical user interface (GUI) application;
- a database; and
- an SMS server.

10

17. Apparatus according to Claim 16 wherein the further processor device is operatively associated with a transmitter and the GUI application includes user input functions permitting one or more of:

- the addition of an asset;
- 15 • alteration of the recorded details of an asset;
- deletion of an asset;
- display of the recorded details pertaining to an asset;
- the generation and sending via the transmitter of a request for data from the first processor device;
- 20 • the generation and sending via the transmitter of one or more messages, to the first processor device, causing configuration of one or more registers in the first processor device.

18. Apparatus according to Claim 16 or Claim 17 wherein the GUI application  
25 generates one or more messages, for display via the display device, in dependence on signals received from the first processor device.

19. Apparatus according to Claim 16, 17 or Claim 18 wherein the database  
includes data pertaining to one or more of:

- 30 • the identity of a said asset;
- the identity of the owner or user of a said asset;
- a description of a said asset;
- a data number indicative of a GSM modem secured to a said asset;

- a “host” data number indicative of a GSM modem operatively associated with the database, the said data number being associated with a said asset;
- data indicative of the usage status of a said asset.

5

20. Apparatus according to Claim 19 wherein the or each data number is or includes a mobile telephone number.

21. Apparatus according to Claim 16 or any preceding claim depending therefrom, wherein the SMS server includes software for carrying out one or more of:

10 monitoring the receiver and conditioning signals received thereby;  
transferring data contained therein to the database; and/or  
conditioning commands generated by the GUI application for  
15 transmission.

22. Apparatus according to Claim 17 or any preceding claim depending therefrom, including a receiver operatively associated with the first processor device wherein when the GUI application generates one or more conditioning  
20 commands causing configuration of one or more registers in the first processor device such commands may include data for altering, in the first processor device, one or more of:

- a host data number;
- a usage status of a said asset indicative of an impending need for a  
25 service operation;
- a usage status of a said asset indicative of passing of a scheduled time for a service operation; and/or
- a predetermined usage status that is regardless of a need for servicing.

30

23. Apparatus according to any preceding claim, including a common support structure to which are secured the interface, the first processor device and the first transmitter.

24. A motor vehicle including a CAN-BUS having operatively connected thereto the interface of an apparatus according to any preceding claim.
- 5 25. Use of an apparatus according to any of Claims 1 to 24 in a method monitoring of the usage status of an asset.
26. A method of monitoring the usage status of an asset (as defined herein) including a data transfer assembly, the method comprising:
- 10 via an interface operatively connected thereto, accepting data indicative of a usage status from a said data transfer assembly;
- processing the said data, using a programmable first processor device, whereby to convert it to SMS format;
- transmitting the thus converted data via a first transmitter to a first receiver
- 15 located remotely therefrom;
- processing SMS data received by the receiver using a further programmable processor device to convert the said SMS data to a format suitable for display via a display device; and/or
- generating one or more messages, that are displayable via the display
- 20 device, in dependence on the content of the said SMS data received by the receiver.
27. A method according to Claim 26 including the sub-step of accepting data via the interface from a data transfer assembly in the form of a CAN-BUS.
- 25 28. A method according to Claim 26 or Claim 27 including the step of storing data in a memory that is operatively associated with the first processor device.
29. A method according to any of Claims 26 to 28 including the transmission
- 30 via the first transmitter of one or more signals when data accepted via the interface from a said data transfer assembly signifies a pre-defined usage status of a said asset.

30. A method according to Claim 29 wherein the data signifying a predetermined usage status includes:
- (i) that a pre-defined action is needed; and/or
  - (ii) that a pre-defined quantum of usage of a said asset remains before a  
5 service operation becomes desirable; and/or
  - (iii) that the scheduled time for a service operation has passed; and/or
  - (iv) that the asset has achieved a predetermined amount of usage,  
regardless of a need for servicing.
- 10 31. A method according to Claim 30 wherein the interface is connected to a said data transfer assembly of a wheeled vehicle including an odometer an instantaneously prevailing reading of which is transferred at least intermittently via the data transfer assembly, wherein the said data signifying the usage statuses (i) - (iii) includes data pertaining to a said instantaneously prevailing odometer  
15 reading transferred via the said transfer assembly.
32. A method according to Claims 29, 30 and 31, wherein the first processor device compares the data pertaining to the instantaneously prevailing odometer reading to one or more predetermined odometer readings pertaining to a need for a  
20 service operation; and, in dependence on the outcome of the comparison, generates one or more said predetermined signals.
33. A method according to Claim 29 or any preceding claim depending therefrom wherein the first processor device generates the or each signal as a  
25 coded SMS message indicative of a said usage status.
34. A method according to Claim 33 wherein each said coded SMS message contains data in the form of one or more field of hexadecimal code.
- 30 35. A method according to Claim 33 or Claim 34 wherein the or each signal contains data identifying the asset and data indicative of the status of one or more registers of the first processor device.

36. A method according to Claim 29 or any preceding claim depending therefrom wherein the or each signal includes data indicating one or more of:

- (a) the identity of a said asset;
- (b) the aggregate usage of the asset;
- 5 (c) the owner of the asset;
- (d) the user of the asset;
- (e) a description of the asset;
- (f) data numbers relating to the asset and/or a host represented by the receiver;
- 10 (g) the activation of one or more condition warning devices of the asset;
- (h) the extent of usage of ancillary parts of the asset;
- (i) the duration of use of the asset;
- (j) the relative amounts of usage time and non-usage time of the asset;
- 15 (k) whether the usage of the device exceeds predetermined or manufacturer-specified recommendations;
- (l) the location of the asset; and/or
- (m) the usage of the vehicle over a period preceding a malfunction or accident.

20

37. A method according to any of Claims 26 to 36 including the use of one or more GSM modems for the transmission and receipt of signals indicative of the usage status of an asset.

25 38. A method according to any of Claims 27 to 37 including the use in the further processor device of a GUI application, a database and an SMS server for the processing of data received by the receiver.

39. A method according to any of Claims 26 to 38 wherein the further  
30 processor device is operatively associated with a transmitter, the method including the step of using the GUI application for one or more of:

- the addition of an asset;
- alteration of the recorded details of an asset;

- deletion of an asset;
  - display of the recorded details pertaining to an asset;
  - the generation and sending via the transmitter of a request for data from the first processor device;
- 5 the generation and sending via the transmitter of one or more message, to the first processor device, causing configuration of one or more registers in the first processor device.

40. A method according to Claim 38 or Claim 39 including the step of causing  
10 the GUI to generate one or more messages, for display via the display device, in dependence on signals received from the first processor device..

41. A method according to Claim 38 or any preceding claim depending  
therefrom including the step of storing in the database data pertaining to one or  
15 more of:

- the identity of a said asset;
- the identity of the owner or user of a said asset;
- a description of a said asset;
- a data number indicative of a GSM modem secured to a said asset;
- 20 • a “host” data number indicative of a GSM modem operatively associated with the database, the said data number being associated with a said asset;
- data indicative of the usage status of a said asset.

25 42. A method according to Claim 41 wherein the or each data number is or includes a mobile telephone number.

43. A method according to Claim 39 or any preceding claim depending  
therefrom, wherein the SMS server includes software for carrying out one or more  
30 of:

- monitoring the receiver and conditioning signals received thereby;
- transferring data contained therein to the database; and/or

conditioning commands generated by the graphical user interface application for transmission.

44. A method according to Claim 39 or any preceding claim depending  
5 therefrom, wherein when the GUI application generates one or more conditioning  
commands causing configuration of one or more registers in the first processor  
device such commands may include data for altering, in the first processor device,  
one or more of:

- a host data number;
- 10 • a usage status of a said asset indicative of an impending need for a  
service operation;
- a usage status of a said asset indicative of passing of a scheduled  
time for a service operation; and/or

a predetermined usage status that is regardless of a need for servicing.

15

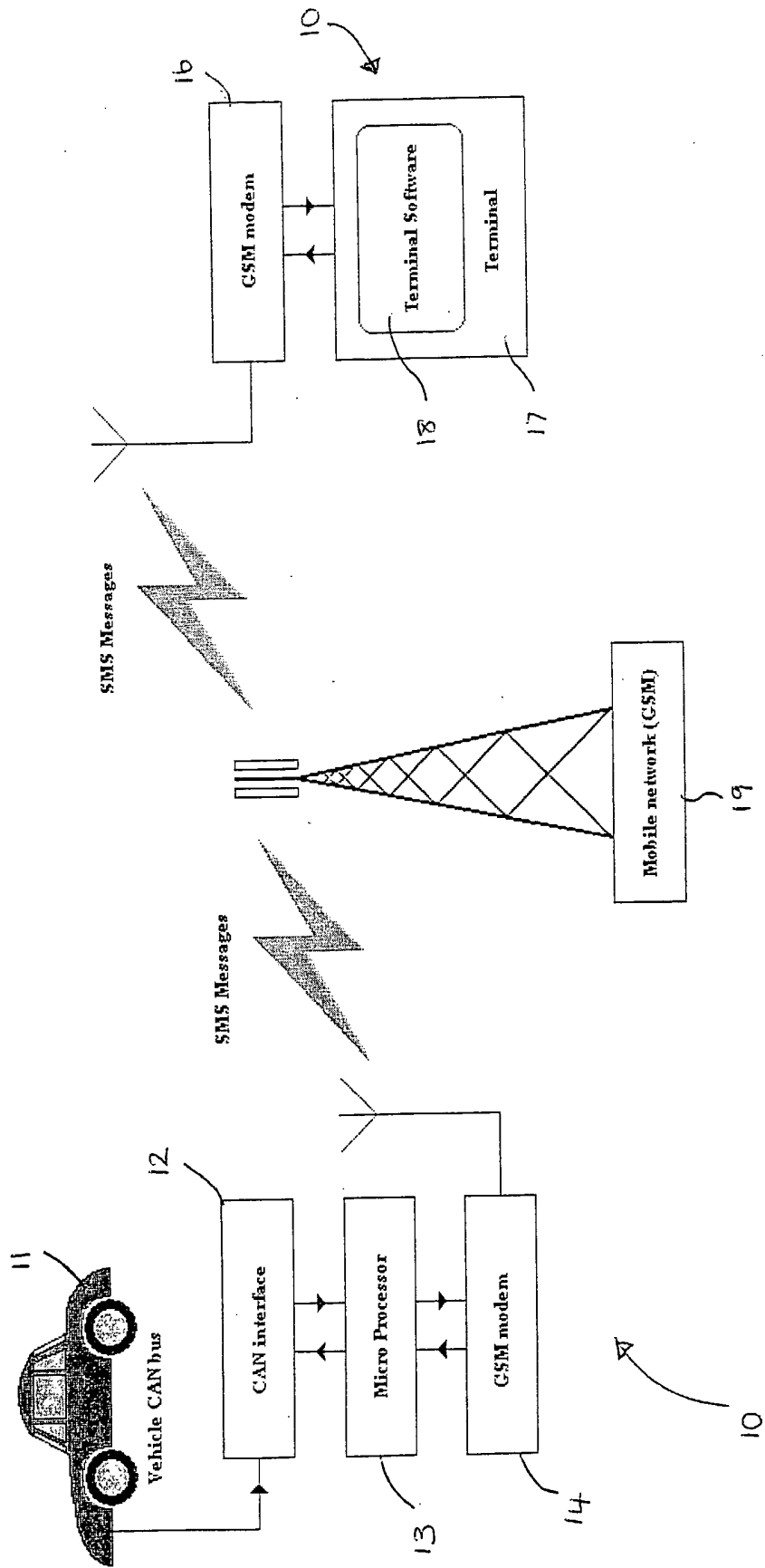
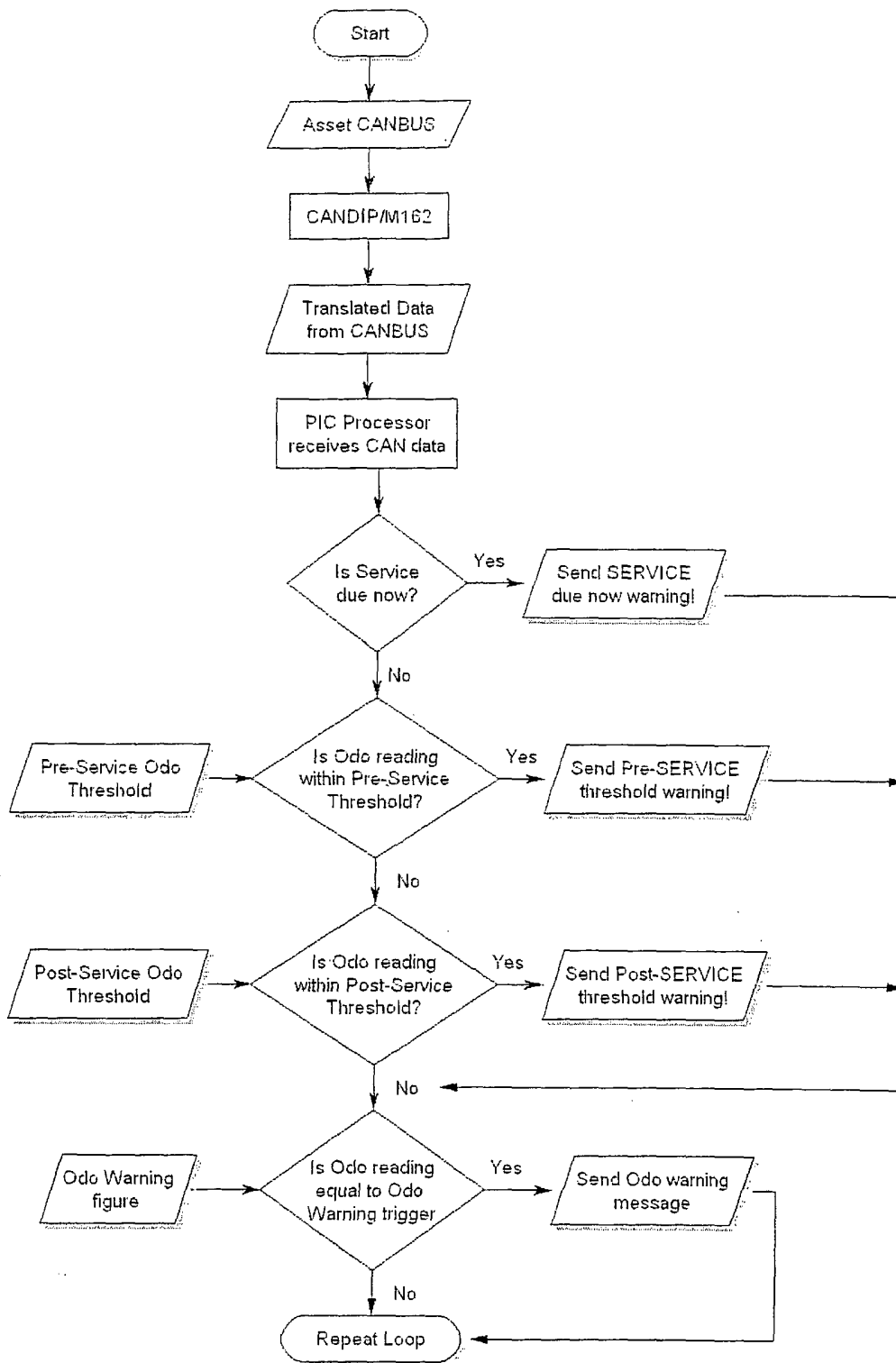


Figure 1



Title: Service Indicator Firmware - CANBUS Processing  
Author: Tim Bishop of Smart-Trac UK Limited  
Client: FollowIT UK Limited  
Date: 26<sup>th</sup> September 2004 FOLLOWIT

Figure 2

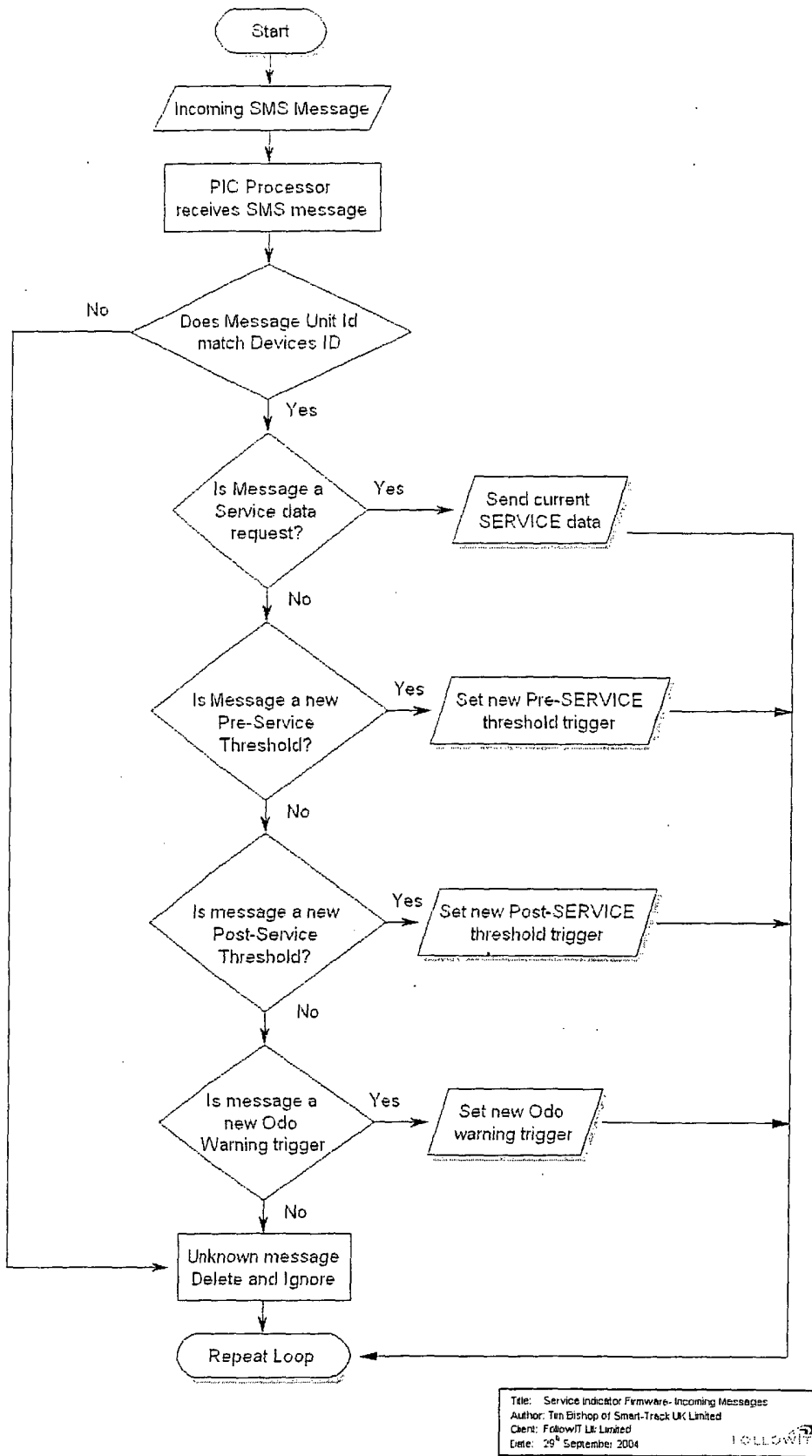


Figure 3

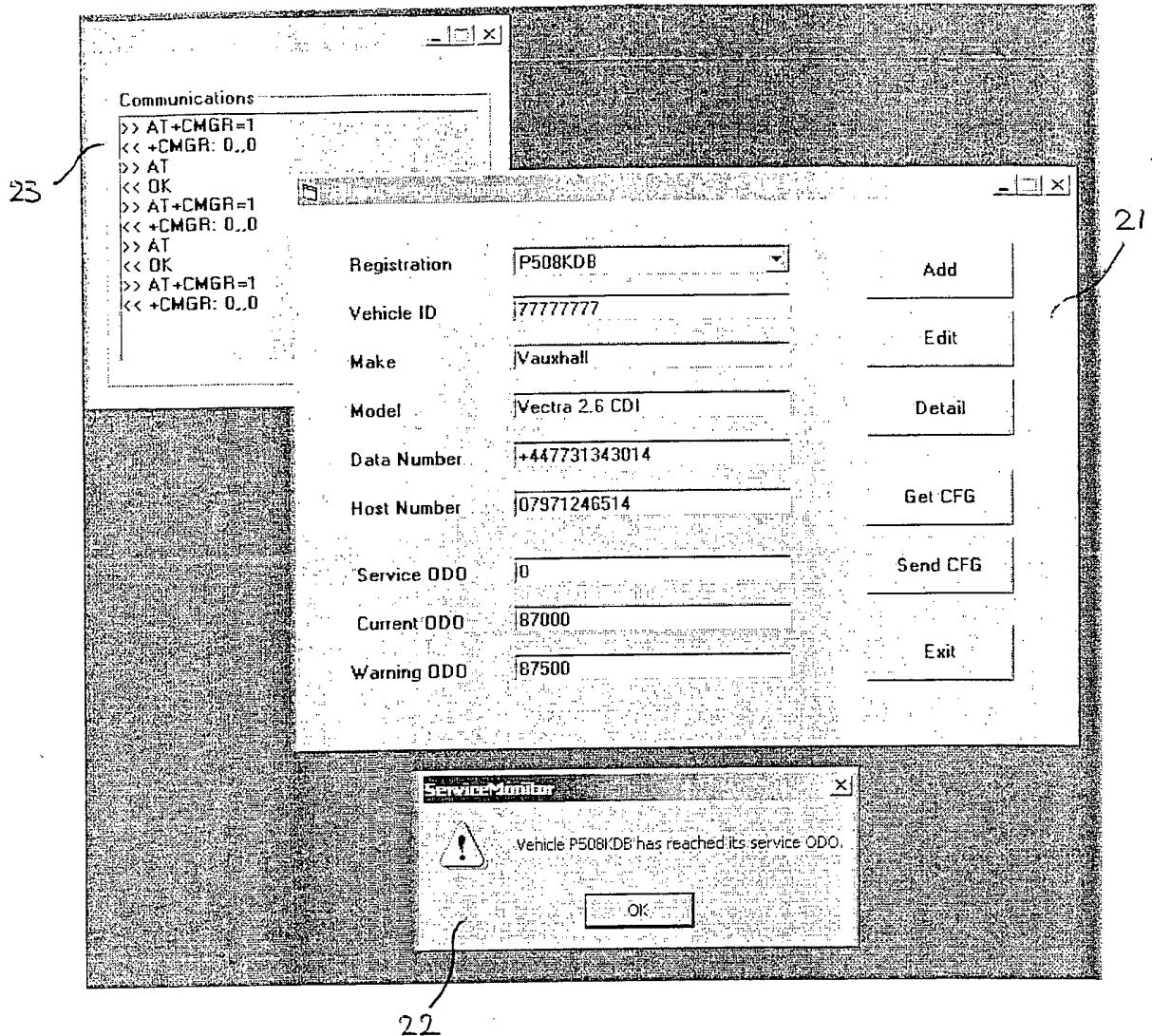


Figure 4

**INTERNATIONAL SEARCH REPORT**

International Application No /GB2005/003936
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**A. CLASSIFICATION OF SUBJECT MATTER**  
 G07C5/00      G07C5/08

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)  
 G08G    G07C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)  
 EPO-Internal, WPI Data

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y	page 6, line 4 - page 11, line 29  figures 2-12	2, 6, 7, 21, 22, 24, 27, 30, 31, 43, 44

Further documents are listed in the continuation of box C.       Patent family members are listed in annex.

° Special categories of cited documents :

*A* document defining the general state of the art which is not considered to be of particular relevance	*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
*E* earlier document but published on or after the international filing date	*X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
*L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	*Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
*O* document referring to an oral disclosure, use, exhibition or other means	*Z* document member of the same patent family
*P* document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search  19 January 2006	Date of mailing of the international search report  30/01/2006
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Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer  Miltgen, E
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## INTERNATIONAL SEARCH REPORT

ational Application No

/GB2005/003936

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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