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(54) **Telemetry system for a vehicle fleet**

(57) A system for remote control of vehicles or machines based on a client/server architecture, wherein a fixed central unit, or remote server, receives data from a plurality of said vehicles, said data being acquired by a set of sensors positioned on each of said vehicles.

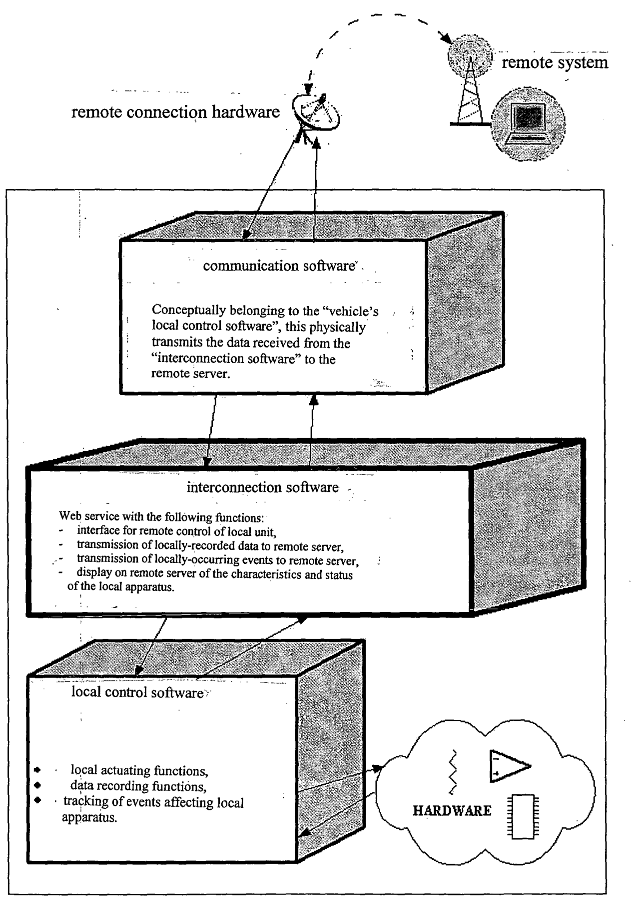

Fig.5

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Description

BACKGROUND OF THE INVENTION

[0001] There are known systems for detecting the position of hired vehicles, such as US patent 6,025,774; or systems for detecting the position of vehicles, and particularly industrial vehicles, such as vans and trucks, and the related goods or pallets; see application US2002/089434, for instance, wherein the signals are transmitted via a GPS/GSM modem; or systems for identifying the position of individuals, for access control, or for tracking and locating movable goods, as described in US patent 5,363,425, wherein the signal is transmitted via the telephone network. Moreover, there are known systems for ascertaining the position of an object at predetermined time intervals, using a local or global detection system connected to a central system, as in US patent 5,497,149.

SUMMARY OF THE INVENTION

[0002] A remote control system for a set of resources, based on a client/server architecture, wherein a fixed central unit, or remote server, on the office side receives data from a plurality of sensors positioned on each of the resources by means of a straightforward and intuitive interface, advantageously comprising a further interface with accounting software and the opportunity to link the control center to the Internet, thus making it accessible from anywhere. The connection between the server and the resources can be advantageously achieved using GSM, GPRS or RF technology, with the opportunity to send text messages (SMS) to report any anomalies or manhandling alarms, to send data acquired up until that time when prompted to do so, and to disable the resource itself from the remote server by telephone, GPS or GPRS connection.

[0003] In an advantageous embodiment of the invention, the link between the server and the resources takes the form of web services with a straightforward interface on the user side, so that the resources can be controlled from any Internet access point.

[0004] Each resource includes the aforesaid sensors, which enable the acquisition of information, such as details on the operation of motors, batteries (if any), or electronic components, as well as enabling the working or operating hours of the resource to be counted, or compulsory servicing stoppages to be scheduled.

[0005] The remote control system according to the invention is advantageously powered with the resource's batteries and/or with an independent power supply.

[0006] Moreover, the maximum mechanical inviolability of the system is preferably assured, and a control system with the keyboard and display can be included to monitor the functions of each resource in situ.

[0007] In addition, the telephone link is advantageously managed by means of phone cards, preferably based on a single caller card whereon, for instance, a plurality of data can be saved referring to a plurality of clients.

[0008] In fact, it could be set up a local network by GSM/GPS connection to control a plurality of resources, especially comprising a logic unit and a radio transmitter on a main resource and further logic units and radio transmitters in the others.

[0009] In this way the system is less expensive since there is no necessity to buy a large number of phone or GSM cards.

[0010] Further the data transmission by GSM network is restricted to a single resource.

[0011] The advantages of a remote system according to the invention derive from the fact that it improves the control of resources such as vehicle fleets, reducing the servicing costs, since servicing is done only as and when necessary and routine servicing tests can be scheduled, and the power to the vehicle can be disabled from the remote site.

[0012] In the case of a fleet of hire cars or an outsourcing service, the application of the system according to the invention is particularly advantageous because it enables the functions and usage of each vehicle to be monitored. In fact, in the case of hire cars, the data obtained by the system can advantageously be sent directly to the server of the company that owns the vehicles, either continuously or at scheduled intervals, e.g. once a day or once a week. From the management standpoint, other advantages lie in the opportunity to invoice the real usage of the car or to issue invoices routinely, e.g. once a month.

SHORT DESCRIPTION OF THE FIGURES

[0013] The present invention can be better clarified and its numerous objects and advantages will become evident to persons skilled in the art by referring to the attached schematic drawings, which illustrate a non-restrictive practical example of the invention. In drawing la:

- Figure 1 shows an example of the central unit, or server, according to the invention;
- Figure 2 shows a general layout of the present invention;
- Figure 3 shows an example illustrating the signals and the sensors that monitor the corresponding components;
- Figure 4 shows a block diagram illustrating the architecture of the software;
- Figure 5 is a summary diagram of the system;
- Figure 6 shows an example layout of the control system;
- Figure 7 shows a summary diagram of the invention for a forklift truck.

DETAILED DESCRIPTION OF SOME PREFERRED EMBODIMENTS OF THE INVENTION

[0014] The invention relates to a system for the remote management of a vehicle fleet, advantageously of industrial vehicles such as forklift trucks, graders and diggers, without ruling out other types of machine, such as road transport vehicles, vehicles for courier transport services, or refrigerated trucks, or electric machines, such as machines for cleaning industrial environments or offices, for instance. This vehicle fleet is advantageously composed of a plurality of the same type of vehicle, or of vehicles that serve the same purpose, or of a plurality of different vehicles, each of which is controlled by the same remote system by means of one or more sensors. The control system according to the invention mainly comprises both hardware and software components. To be more precise, see Figure 1, it consists of a hardware system to install in a remote machine, or server, in which software is installed to manage needs, plus a control environment, preferably suitable for use via Internet.

[0015] The central unit, see Figure 2, is in the form of programmable components capable of managing the processing and storage of signals acquired by the sensors and of controlling outside peripheral units by implementing communication interfaces. Examples of the communication interfaces that can be used according to the present invention are Bluetooth, Canbus, i2c, spi, rs232, rs485 and Irda. The central unit is capable of communicating with a data acquisition board designed to implement the remote link, while the monitoring system is advantageously powered by a battery, or by a power supply unit that is separate from the machine, should the battery fail. Every vehicle or machine is preferably enabled by an electronic key and interfaced via a data acquisition board with the central unit, which controls its usage.

[0016] The purpose of the hardware for the monitoring system, needed for the remote control of a vehicle, is to acquire and process signals, and to provide a communication interface with the outside world.

[0017] The signals are acquired by means of a plurality of sensors positioned on each vehicle or machine being monitored.

[0018] Figure 3 illustrates a generic system of sensors and corresponding signals for a vehicle being monitored by the control system according to the invention. Generally speaking, a vehicle has more than one electric motor and the power absorbed by each motor is advantageously monitored using a Hall-effect current sensor, whose signal is first filtered, and then conditioned and converted into a digital signal. In some cases, there is a brush wear detector on each of the motors, and each of these detectors is interfaced with the data acquisition board, advantageously converting the opening command into an electric signal. In cases when the relevant signal is available, it is advantageously used to monitor the temperature on each of the motors. After amplification, such signals are also converted into digital signals.

[0019] The vehicle generally has power devices that drive the electric motors: the temperature of these power devices is advantageously monitored by a sensor for each device. The signal from the sensor is filtered, then conditioned and converted into a digital signal.

[0020] The vehicle also has at least one battery, and the voltage from said battery is monitored by means of a part of the circuit on the data acquisition board, which filters, conditions and converts the signal. The current delivered by the battery is advantageously monitored using a Hall-affect current sensor, the signal from which is first filtered, and then conditioned and converted into a digital signal.

[0021] The temperature of the data acquisition board is preferably measured by means of a sensor situated on the board itself.

[0022] Any circuit-breakers, e.g. safety cut-outs, are advantageously monitored using a contact installed on a panel for accessing the wiring. The contact is preferably interfaced with the data acquisition board, converting the opening command into an electric signal.

[0023] A humidity sensor situated in the vicinity of the battery is advantageously used to measure the humidity in the battery case. The signal providing the relative humidity value is conditioned so that it can interface with an analog/digital converter. The digital information is then transferred to the data acquisition board.

[0024] The temperature in the battery case is advantageously measured by means of a sensor that is also situated, like the humidity sensor, in the vicinity of the battery. The signal indicating the temperature in the battery case is conditioned so that it can interface with an analog/digital converter. The digital information is then transferred to the data acquisition board.

[0025] Moreover, there are also advantageously provided microswitches that reveal the presence of an operator in the vicinity of the vehicle, interfaced with the data acquisition board using the existing wiring and apparatus. The opening command is also advantageously converted into an electric signal.

[0026] Any other acoustic signaling devices possibly provided on each of the vehicles to control, are monitored by measuring the power absorption at their terminals to recognize when they are functioning, for example.

[0027] The ambient temperature is preferably measured by means of a sensor situated on the outside of the vehicle. The signal that provides the ambient temperature is conditioned so that it can interface with an analog/digital converter.

[0028] Where possible, the wiring exploits the presence of wires already existing in the vehicle and, for wires terminating with connectors, the wiring is by means of an adapter; the signals are advantageously optoisolated, wherever possible.

[0029] Figure 4 describes the software architecture on the vehicle side, consisting in two parts, conceptually distinguishable as one part for communication purposes and one for local vehicle control.

[0030] The local control part is concerned with recording data on the vehicle, processing said data where necessary, keeping track of any events that occur and locally managing the vehicle concerned.

[0031] The software comprises functions whose purpose is to acquire data, execute commands and record events; see summary diagram in Figure 5.

[0032] These functions can advantageously have a two-way interface with the remote system so that they can be controlled and triggered by the latter.

[0033] Depending on the physical construction of the machine, physical actions thereon, such as the stoppage of the vehicle and the selection of its operating parameters, are made possible by means of the actuator functions, be they triggered directly by the remote unit or processed in programmed mode.

[0034] The status of the vehicle can be recorded using the data acquisition functions, and this information can be saved.

[0035] The event tracking functions can be used to keep a record of what happens to the vehicle.

[0036] Finally, this part is concerned with managing the transmission and reception of data to and from the remote unit (at hardware level).

[0037] The part conceived for the purpose of communication with the remote system is concerned with the transmission of data to and from the vehicle. In addition to data needed for proper local/remote communications, the data output also has to do with measurements taken locally and with events happening to the vehicle.

[0038] The data input includes commands for the remote control of a vehicle.

[0039] In an advantageous embodiment of the invention, communication is via the SOAP protocol (e.g. http://www.w3.org/.../part1/ and the like) and data are consequently serialized in XML format (e.g. http://www.w3.org/....../XML/ and the like). The functions of a vehicle are advantageously made available to the remote system in the form of web services. Access to these functions can be made subject to the remote system satisfying an authentication request elicited by the vehicle. Access to a vehicle's functions can be linked to specific authorizations deriving from the authentication procedure.

[0040] The control system, see Figure 6, is advantageously composed of a specification framework for the link with the remote equipment, or server, achieved preferably using an application server, e.g. a J2EE compliant type, with a framework for managing and generating html pages using XML and XSLT. The information relating to the resources available is contained in a database to which the environment is connected.

[0041] Using a straightforward web interface, the technician can advantageously access remote resources and perform thereon the operations that said resources offer as web services. The technician may also change, add or remove said resources.

[0042] Although the program is advantageously event-driven in the preferred embodiment of the invention, guidelines may also be identified to characterize its flow of operations.

[0043] When you access the program, you are prompted to provide a login and a password in order to enable the service; then the connection to the database is made - this is made persistent to guarantee the completion of the single transactions. The database contains tables relating to the users (i.e. to the person using the web application), the nodes (i.e. the geographical location that identifies a set of resources), the resources (i.e. the equipment that is controlled by interfacing it with the communication channel) and the allowable communication modes. Information is provided in the table of users on the various types of user; in fact, different authorizations can be granted to different users on the single resources, giving rise to different access levels.

[0044] Once the resource to control has been selected, an interface is presented that offers different communication channels which can be selected to enable the actual link. Interaction with the peripheral units is obtained by selecting one or more of the possible components and "enabling" them with a click to view their characteristics on the screen. Advantageously using an XSLT conversion, the data obtained via the link (in XML format, for instance) are processed and then displayed on the screen.

[0045] The procedures for changing the characteristics of components (i.e. the set of equipment, such as the sensors or the mechanical components, connected to the resource being controlled) are preferably simple HTTP POST transactions of form data obtained by the XML code, encapsulated in SOAP messages.

[0046] Furthermore, a remote control system according the present invention can advantageously use for the communication e-mail messages or else short messages or SMS via GSM/GPS connection. In this way the protocol used is the same as the communication protocol described before, the only difference being essentially that, using SMS communication, transmission is probably and advantageously divided in several messages, because this communication has a limited numbers of characters available, while e-mail communication can transmit much more data.

[0047] In this case the graphic interface is advantageously programmed e.g. in VISUAL BASIC or VISUAL C, so as to make it more customable and more elegant.

[0048] Moreover this graphic interface allows to execute commands and to control resources remotely substantially as described before. It will now be described in more detail, by way of example, a signal acquisition system for a forklift truck of the R60-30 type, as illustrated and described below and with reference to Figure 7.

[0049] A first type of signal is the one that refers to the safety of the driver using the forklift. In this case, a cover

over the battery case (not aus) is controlled by a safety circuit-breaker situated in the vicinity of the driver's seat, normally wired underneath the cover on the battery case. The not aus connector is protected by a plastic panel that is easily accessible to the truck driver, who could short-circuit the contact and condition its action. Given the type of not aus signal (this is a normal circuit-breaker), it is impossible to tell whether the not aus is in working order or not, unless the driver is obliged to perform a test every time the truck is turned on. Given the typical usage of such a vehicle, this is hardly feasible, so a microswitch is advantageously installed on the plastic panel to protect the not aus, underneath the cover on the battery case, that reveals whether the cover has been opened and thus signals that it may have been manhandled. The check on the operation of the not aus is thus converted into a check on any tampering with the panel underneath the cover on the battery case.

[0050] A microswitch for revealing the presence of the driver on the forklift is situated inside the seat, but it can easily be tampered with because the connector is situated above the battery case, on the outside of any panel (said position prevents any attempt to install an anti-tamper device).

[0051] The type of signal to control (as in the case of the not aus) and the exposure of the connector consequently makes it impossible to check its operation or add an anti-tamper device. Since this signal is considered strictly linked to the normal use of the forklift, it is judged advisable to design a system for recognizing its proper use via software. For instance, the software may advantageously check to ensure that the driver's seat remains in the raised position for at least five minutes between one forklift ignition and the next.

[0052] When reverse gear is engaged, the driver is seated and the accelerator is pressed, a buzzer is tripped by a card fitted with a relay. This buzzer can be tampered with by disconnecting the wires. To ascertain whether the buzzer is connected involves measuring the power absorption at its terminals when it is functioning (we only need to know whether a current is circulating, not how much current is involved). It would be excessively expensive, however, to establish whether all the conditions are met that trip the buzzer so, considering the normal use of the forklift, it ought to be enough to make sure, via the software, that some power absorption occurs at the buzzer terminals during the course of a working session (e.g. 8 hours), which is tantamount to imposing the constraint that the reverse gear be engaged at least once every 8 hours of truck operation.

[0053] The same electrical considerations apply to a flashing light as to the buzzer, but with one difference: the flashing light comes on when the ignition key is turned (or when the controls are enabled), so its operation can be checked continuously and reliably.

[0054] A horn is enabled by a switch situated on the truck's platform. The power absorption of the horn can be measured, but this can only be done if the switch is pressed; so a control is needed to report this information to the black box. The presence of already-installed wires on the forklift makes the installation of said control system straightforward.

[0055] This control system can also be used to signal any malfunctions to the driver.

[0056] The wiring of these signals is advantageously non-invasive (all arriving at the forklift's main electronics), with the exception of the not aus anti-tamper microswitch and the extra wire used to check the horn switch. For the latter, a switch has to be adapted to the hatch and two wires have to be fed to the tank. The signals considered critical as far as the risk of driver tampering is concerned are the buzzer, the seat and the not aus.

[0057] A second type of signal is the one for monitoring the battery. The characteristics of the battery are checked to keep it in good working order, ensuring the signaling of any improper use. The term improper use is intended here to mean the lack of ordinary maintenance (topping up the water in the battery elements, spillage of water in the battery case) and/or a faulty recharging procedure (partial recharges that give rise to a memory effect).

[0058] When topping up with distilled water, some of the water may spill into the case, leading to a load loss, rusting and the perforation of the case. A humidity sensor can be used to check for this condition by detecting the evaporation of the liquid in the tank when the battery becomes warm. The sensor can be installed on the cover over the battery case, where the anti-tamper switch is already installed.

[0059] The shortage of water in a battery element causes an increase in the battery's internal resistance. When current is delivered, this parasite resistance causes an increase in the temperature of the elements and interferes with the battery's current-voltage characteristic. The most significant quantity is nonetheless the temperature.

[0060] Another cause of damage is when the battery is discharged completely. The voltage of the single element is estimated (advantageously by measuring the voltage of the battery set) and this error condition is consequently reported. The battery's voltage can be monitored where the forklift's main electronics are located.

[0061] Partially recharging the battery reduces its working life. The presence of two or more batteries per forklift and the opportunity to swap them over makes it impossible to measure the recharging time directly, and anyway this may be scarcely significant because different battery-chargers have different currents (the quality of the charge depends on the charging time, the current delivered by the battery-charger and the capacity of the battery). Because of the memory effect, partial recharging influences the battery's discharging current-voltage characteristic. Measuring the latter enables to monitor any decline in performance: generally speaking, in fact, when a battery is only partially recharged, it reaches the nominal voltage but is unable to guarantee the necessary current delivery, so voltage rapidly runs down.

[0062] The variety of possible types of behavior demand an accurate study of the batteries in use. The quantities to measure are the voltage at the battery terminals and the current delivered, using a Hall effect sensor. The best way to monitor the proper recharging of the battery (and consequently check for any partial recharging procedures) is to take action directly in the battery case (and thus remain with the batteries when they are being recharged).

[0063] The wiring needed for the acquisition of these signals is mainly inside the rear tank. The temperature and humidity sensors are advantageously positioned underneath the cover on the battery case and can also be protected by the same anti-tamper device of the not aus.

[0064] A third type of signal controls the operation of the motor. The maximum number of motors considered is four: two for traction, one for lifting and one for steering. There are two types, i.e. separate excitation and serial excitation. The motors are fitted with internal temperature sensors and a contact that alerts the user when wear on the brushes becomes excessive.

[0065] Both signals are accessible near the main electronics. An excessive strain on the motors destroys the general power electronics.

[0066] Wear on the brushes is monitored by a contact inside the motor. Prolonged use of worn brushes destroys the motor. The contact for checking brush wear arrives in the rear tank.

[0067] Excessive power absorption by a motor, caused by a malfunction or improper use of the forklift, can destroy a single terminal and make it necessary to replace the whole general power electronics. Monitoring the power absorption of each motor enables to keep track of the motors' crucial operating conditions and safeguard the terminals in the power electronics. Single absorptions are advantageously measured by a specifically-designed "current clamp" integrated in the black box using Hall effect sensors. The motors' power absorption must be measured, by means of a current clamp, on all four motors. Using shunts in series is out of the question because these are judged to be invasive, bulky and less adaptable to the various drives.

[0068] A fourth type of signal controls the forklift's general electronics. In fact, it is a good idea to monitor the status of the general electronics to protect the apparatus against conditions of excessive strain. The system has an internal temperature sensor installed in an inaccessible position. In order to display and memorize any overheating of the system, a temperature sensor needs to be installed on the outside. The temperature of the system and the quantity of power delivered to the motors provide information on the strain conditions, enabling an evaluation of whether any action needs to be taken. It is important to take into account the types of system and their position in the forklift in order to establish the position of the wiring.

[0069] A fifth type of signal controls the power supply to the forklift. Depending on the model in question, the power supply to the black box may be 24 V or a value ranging between 36 and 80 V.

[0070] A sixth type of signal controls the connections and wiring. Information on the status of the forklift is sent to the rear tank on a SAB connector. To avoid interfering with the integrity of the already-installed cables, the connection is advantageously made with this connector so as to provide an identical SAB cable output. Before they reach the actuator (buzzer, flashing light), the signals of interest coming from the solenoid valves board are interrupted by the black box so that they can be measured. The sensors that are elsewhere (temperature, humidity, switch, anti-tamper) require a different passage of the wiring for each model. Using the "current clamp" advantageously enables a totally non-invasive wiring on the power side, unlike the use of shunts, which are more bulky and difficult to contain in the box; in fact, the Hall effect sensors are rings inside which one of the two power wires is passed.

[0071] A seventh type of signal controls the stoppage of the forklift truck. Stopping the forklift from the control center simply requires action to be taken on the starter key control, or on the identification card, by disabling it for instance. The forklift advantageously does not stop immediately on receipt of a command to do so, but it is prevented from starting again.

[0072] An eighth type of signal controls the starting of the forklift. The starter key's functions can be advantageously replaced by a card, which becomes the only part of the system visible on the outside and requires a suitable container.

[0073] A multimedia card, smart card or memory stick can be used to check the driver's identity: they all enable the driver to be recognized but they differ in terms of the quantity of information they can store.

[0074] A last type of signal is obtained from shock sensors, used in a manner entirely similar to those used in automotive parts, e.g. for airbags in motor vehicles.

[0075] Returning to the monitoring of battery maintenance, there is a further consideration that, when a battery is recharged, the required voltage (e.g. 80 V) is soon reached at its terminals (in 30 minutes), but for proper recharging the battery must also receive the right amount of current from the battery-charger, which delivers the current slowly to avoid damaging the battery. With partial recharging operations, what happens is that the right voltage is reached at the battery terminals (the 80 V required) but the battery-charger has not had the time to complete the charge (in other words, the battery has not received enough current), so the battery does not have the "strength" it needs to start the forklift for long.

[0076] The following paragraphs describe advantageous ways to overcome the above-mentioned drawbacks.

[0077] In a first solution, the voltage thresholds at the battery terminals (during charging or discharging) and the time the battery remains disconnected from the forklift, which can be considered as the recharging time, are monitored.

[0078] In the case of a hired forklift, the truck itself may have more than one battery pack, so that the customer may be without a power supply only for the time it takes to swap the battery. Moreover, there are numerous battery chargers available that have different battery charging times.

[0079] To overcome these problems, it is useful to consider the solution wherein the black box monitors the discharging characteristic of the battery. In fact, when it is maintained properly, the battery preserves its characteristic (V,t), (I,t) and (V,I), which represent the battery's "vital" graphs. But when it is not maintained properly, e.g. it is only partially recharged, the battery's characteristic (V,t) changes considerably, thus giving the software the opportunity to check for any partial charging, i.e. when a partial charge is performed, the battery fails to deliver the necessary current and quickly goes flat.

[0080] Such a solution demands a series of tests, however, to analyze the characteristics of the batteries in question. This drawback is overcome by the third solution, which involves installing a machine inside the battery case and constantly connected to the battery's poles. In this way, the battery is monitored even during a recharging procedure away from the forklift. When the battery is reinstalled in the truck, the wire connecting the "spy" in the battery case to the black box must also be reconnected, so that the black box can read the data on how, and for how long, the battery has been recharged. This solution enables the type of recharging operation performed and the type of battery-charger used to be monitored with absolute certainty.

[0081] Such a solution involves a greater design cost, a greater manufacturing cost, a greater installation cost. It is naturally a preferable solution only when it is essential to have unquestionable proof of improper use.

[0082] In an advantageous embodiment of the present invention, the system is designed on the hardware side to monitor all the signals, even if only one signal actually has to be monitored. With a minimal initial investment, this solution ensures that the system is already prepared for future expansions.

Claims

1. A remote control system for a fleet of vehicles or machines, based on a client/server architecture, wherein a fixed central system or remote server receives data from a plurality of said vehicles, **characterized in that** said remote control system acquires said data from at least one sensor situated on each of said vehicles.

2. Remote control system according to claim 1, **characterized in that** it includes a control logic situated on a forklift vehicle for processing and analyzing data coming from said sensors or for communicating or executing said data or commands coming from a remote unit.

3. Remote control system according to claim 1 or 2, comprising at least one of the following sensors on at least one of said vehicles:

    - a sensor to measure the ambient temperature, situated on the outside of said vehicle;
    - a sensor to control shocks to which said vehicle can be subjected;
    - a sensor to monitor the status of the general electronics of said vehicle;
    - a sensor to control the starting and/or the stoppage of said vehicle;
    - a sensor to control the power absorption of electric or electronic devices of said vehicle;
    - a sensor to control batteries and/or battery cases of said vehicle;
    - a sensor to control internal combustion engines and/or electric motors of said vehicle.

4. Remote control system according to claim 3, comprising at least one of the following sensors to control the starting or the stoppage of said vehicle:

    - a sensor to control the stoppage engaged from said central system or server;
    - a control sensor to take effect on a starter key control or on an identification card;
    - a sensor to prevent said vehicle from starting again;
    - a sensor to control the starting and to ascertain the identity of the driver.

5. Remote control system according at least to claim 4, **characterized in that** said sensor to control the starting and/or the stoppage of said vehicles is in the form of a key or card.

6. Remote control system according at least to claim 3, **characterized in that** it includes at least one of the following sensors to control at least one electric or electronic device on at least one of said vehicles:- a sensor to control the power absorption at the terminals of an electric or electronic safety or signaling device;

    - a sensor to control the power absorption at the terminals of a buzzer to establish whether said buzzer is connected, said buzzer enabled at least when reverse gear is engaged or a driver is seated or an accelerator is pressed, said power absorption being controlled during the course of a working session by means of software;

- a microswitch sensor inside a seat to detect the presence of the driver on said vehicle and/or to recognize the proper use of said vehicle and/or to recognize if said seat switched off between working sessions;
- a sensor to control the power absorption of an acoustic and/or flashing signal, said signal used to alert about any vehicle malfunctions or to indicate when the accelerator of said vehicle is pressed.

7. Remote control system according to at least claim 3, **characterized by** comprising at least one of the following sensors to control at least one battery on at least one of said vehicles:

- a temperature sensor to control the temperature of said at least one battery;
- a sensor to control the current-voltage characteristic of said at least one battery;
- a sensor to control the terminal voltage of said at least one battery;
- a sensor to control the terminal current of said at least one battery;
- a sensor to control the discharging time of said at least one battery;
- a sensor to control recharging time during which said at least one battery remains disconnected from said vehicle;
- a sensor to control the discharging characteristic of said at least one battery;
- a sensor or a circuit portion of an acquisition card to control the voltage of said at least one battery;
- a temperature sensor to detect the temperature of said battery case;
- a sensor to control the humidity in said battery case;
- a microswitch sensor on a cover for said battery case, to control when the cover is opened and to signal whether it has been tampered with.

8. Remote control system according to at least claim 3, **characterized by** comprising at least one of the following sensors to control at least an internal combustion engine or an electric motor on at least one of said vehicles:

- a sensor to control the temperature of said at least one engine or motor of said vehicle;
- a sensor to control the wear of the brushes of said at least one electric motor;
- a sensor to control the power absorbed by said at least one electric motor;
- a sensor to control the temperature of the power devices that drive said electric motor or combustion engine;
- a sensor to detect the current absorption of said at least one motor including current clamp integrated with a black box by means of sensors.

9. Remote control system according to at least one of the preceding claims, **characterized in that** said sensors are Hall effect sensors.

10. Remote control system according to at least one of the preceding claims, **characterized in that** said sensors include shunts in series.

11. Remote control system according to at least one of the preceding claims, **characterized in that** the transmission of said data from said sensors or of said commands between said central system or server and said vehicles is achieved by means of GSM/GPRS technology or via radio or by means on internet.

12. Remote control system according to at least one of the preceding claims, **characterized in that** said remote control system on said vehicle includes a programmable logic unit and a transmitter that take care of one or more of the following functions:

- acquiring data from said vehicle;
- processing data of said vehicle;
- memorizing events happening to said vehicle;
- local controlling of said vehicles;
- implementation of commands on said vehicles;
- transmitting and receiving data from said sensors and/or commands from and to the remote system.

13. Remote control system according to claim 12, **characterized in that** said implementation of commands on said vehicle is actuated directly from the remote system in real time or processed in programmed mode.

14. Remote control system according to one of claims 11 to 13, **characterized in that** the communication from said vehicles and said remote system is achieved via a SOAP and XML-RPC protocol or the like, and that said data are serialized in XML format to be made available to said remote system in the form of web services.

15. Remote control system according to one of claims 11 to 14, **characterized in that** the communication from said vehicles and said remote system is achieved by a control system composed of a specification framework such as a J2EE compliant type application server.

16. Remote control system according to one of claims

11 to 15, **characterized in that** it includes a web interface on said remote system which offers said data of said vehicle e.g. as web services, VISUAL BASIC or VISUAL C, to access said data and/or to implement commands on said vehicle on behalf of a technician.

17. Remote control system according to at least one of the preceding claims, **characterized in that** it includes at least one of the following steps:

- to require a login and a password to enable the communication and/ or reception of said data and/or of said commands to and from said remote system;
- to start a connection to a database;
- to select one or more of said vehicles to be controlled;
- to present an interface comprising different communication channels;
- to select a communication channels to enable a connection between remote system and vehicle;
- to select one or more of said sensors to display data on said remote system;
- to modify the characteristics of said sensors or to implement commands on said vehicle.

18. Remote control system according to claim 17, **characterized in that** said database contains tables relating to users and/or nodes and/or vehicles and/or support tools and communication's parameters.

19. Remote control system according to claim 18, **characterized in that** said table relating to users contains information relating to different types of user to ensure that different users have different authorizations on each of said resources and to enable different access levels.

20. Remote control system according to at least one of claims 12, 13 or 17, **characterized in that** implementations of said commands on said vehicle are HTTP POST transactions of form data obtained from the XML code.

21. Remote control system according to claim 20, **characterized in that** said implementations of commands are encapsulated in SOAP messages.

22. Remote control system according to at least one of claims 11, 12 or 17, **characterized in that** e-mail messages or short messages (SMS) are used for the communication by means of said GSM/GPS connection.

23. Remote control system according to at least one of claims 11, 12, 17 or 22, **characterized in that** communication is advantageously managed by means of phone cards.

24. Remote control system according to claims 23, **characterized in that** said phone cards are based on a single caller card whereon a plurality of data are saved referring to a plurality of users.

25. Remote control system according to at least one of claims 11, 12, 17, 22 or 23, **characterized in that** a local network by GSM/GPS connection controls a plurality of vehicles.

26. Remote control system according to claims 25, **characterized in that** said local network comprises a logic unit and a radio transmitter on a main vehicle and further logic units and radio transmitters in the other vehicles.

27. Remote control system according to claims 26, **characterized in that** the data transmission by GSM/GPS network is restricted to said main vehicle.

28. Remote control system according to claims 26 o 27, **characterized in that** said other vehicles are connected with said main vehicle by means of radio connection.

29. Remote control system according to at least one of the preceding claims, **characterized in that** said vehicles are industrial vehicles, such as diggers, cranes or the like.

30. Remote control system according to at least one of the preceding claims, **characterized in that** said vehicles use an electric motor, such as machines for cleaning enclosed spaces.

31. Remote control system according to at least one of the preceding claims, **characterized in that** said vehicles to be controlled are road transport vehicles, such as trucks with a refrigerator comprising at least a sensor to control the temperature of said refrigerator.

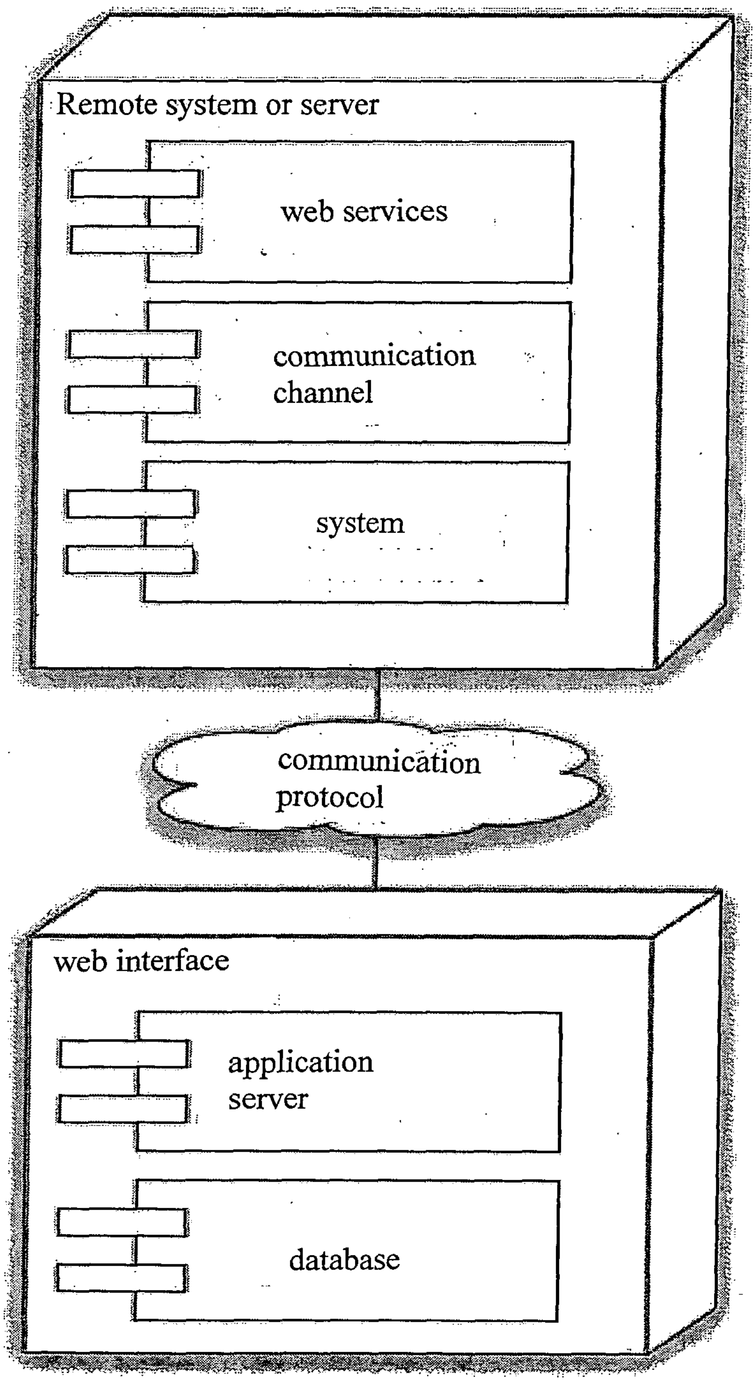

Remote system or server
web services
communication channel
system
communication protocol
web interface
application server
database

Fig.1

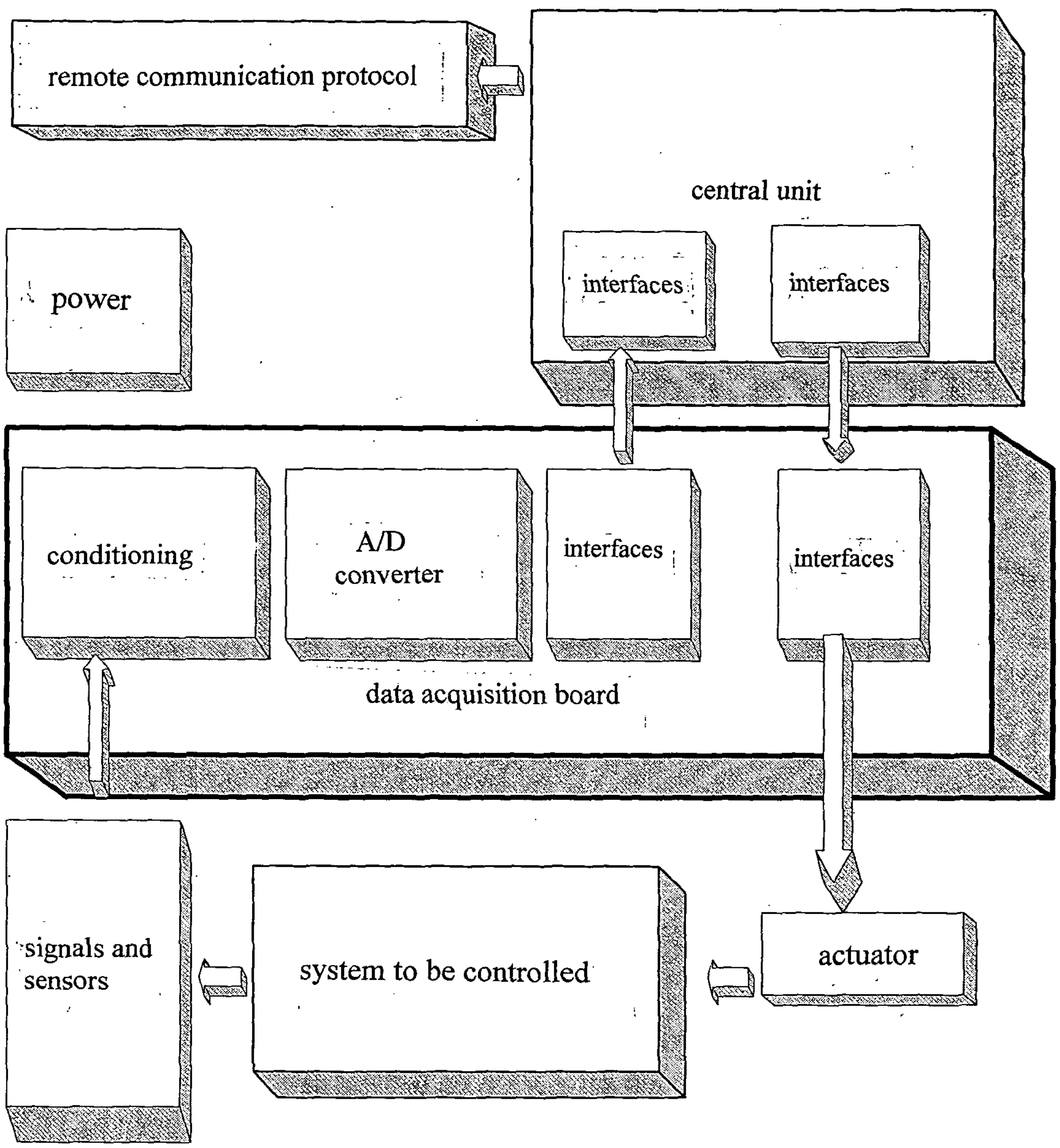

remote communication protocol
central unit
power
interfaces
interfaces
conditioning
A/D
converter
interfaces
interfaces
data acquisition board
signals and
sensors
system to be controlled
actuator

Fig.2

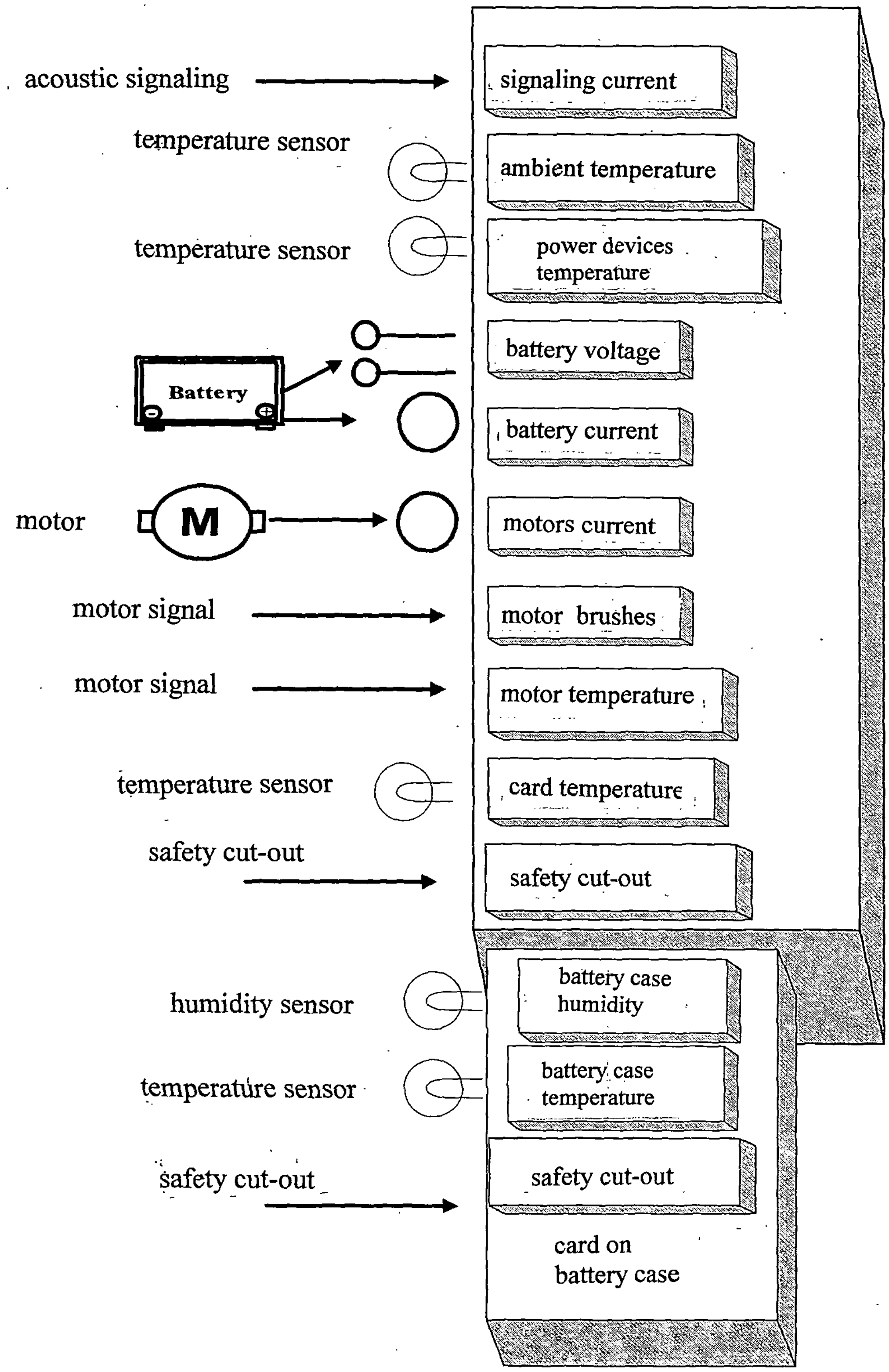

acoustic signaling
temperature sensor
temperature sensor
Battery
motor
M
motor signal
motor signal
temperature sensor
safety cut-out
humidity sensor
temperature sensor
safety cut-out
signaling current
ambient temperature
power devices temperature
battery voltage
battery current
motors current
motor brushes
motor temperature
card temperature
safety cut-out
battery case humidity
battery case temperature
safety cut-out
card on battery case

Fig.3

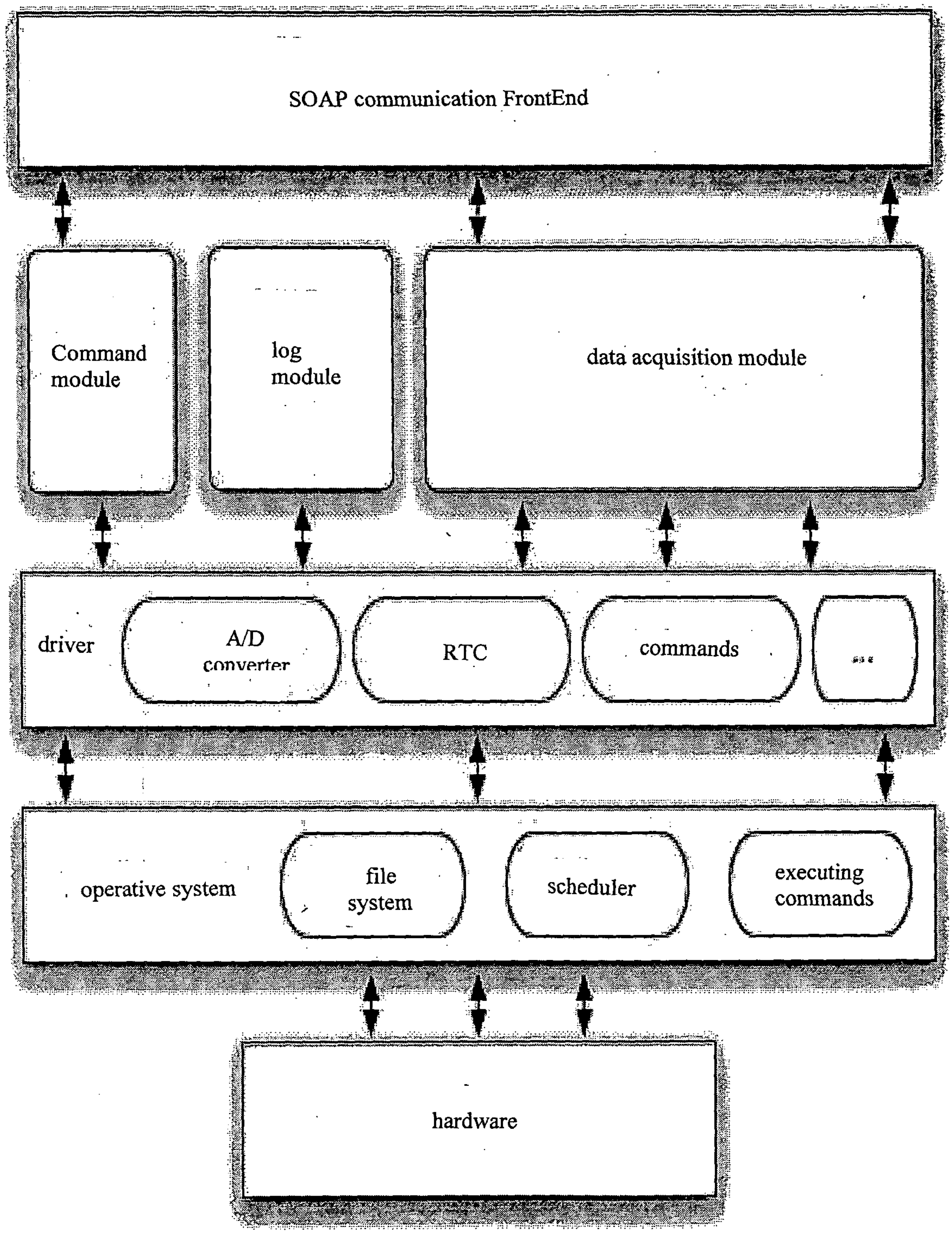

SOAP communication FrontEnd
Command module
log module
data acquisition module
driver
A/D converter
RTC
commands
...
operative system
file system
scheduler
executing commands
hardware

Fig.4

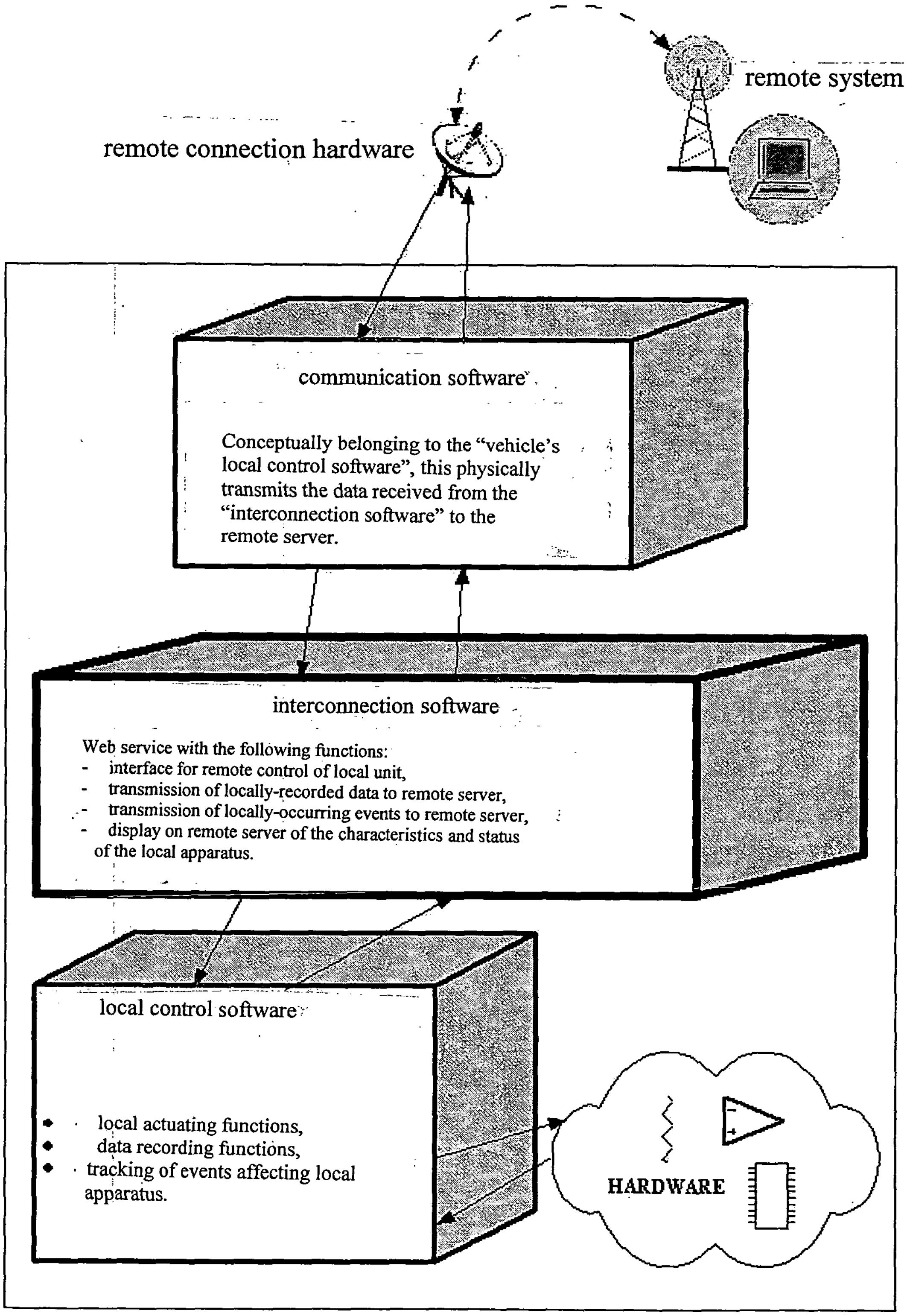

remote system
remote connection hardware
communication software
Conceptually belonging to the "vehicle's local control software", this physically transmits the data received from the "interconnection software" to the remote server.
interconnection software
Web service with the following functions:
- interface for remote control of local unit,
- transmission of locally-recorded data to remote server,
- transmission of locally-occurring events to remote server,
- display on remote server of the characteristics and status of the local apparatus.
local control software
local actuating functions,
data recording functions,
tracking of events affecting local apparatus.
HARDWARE

Fig.5

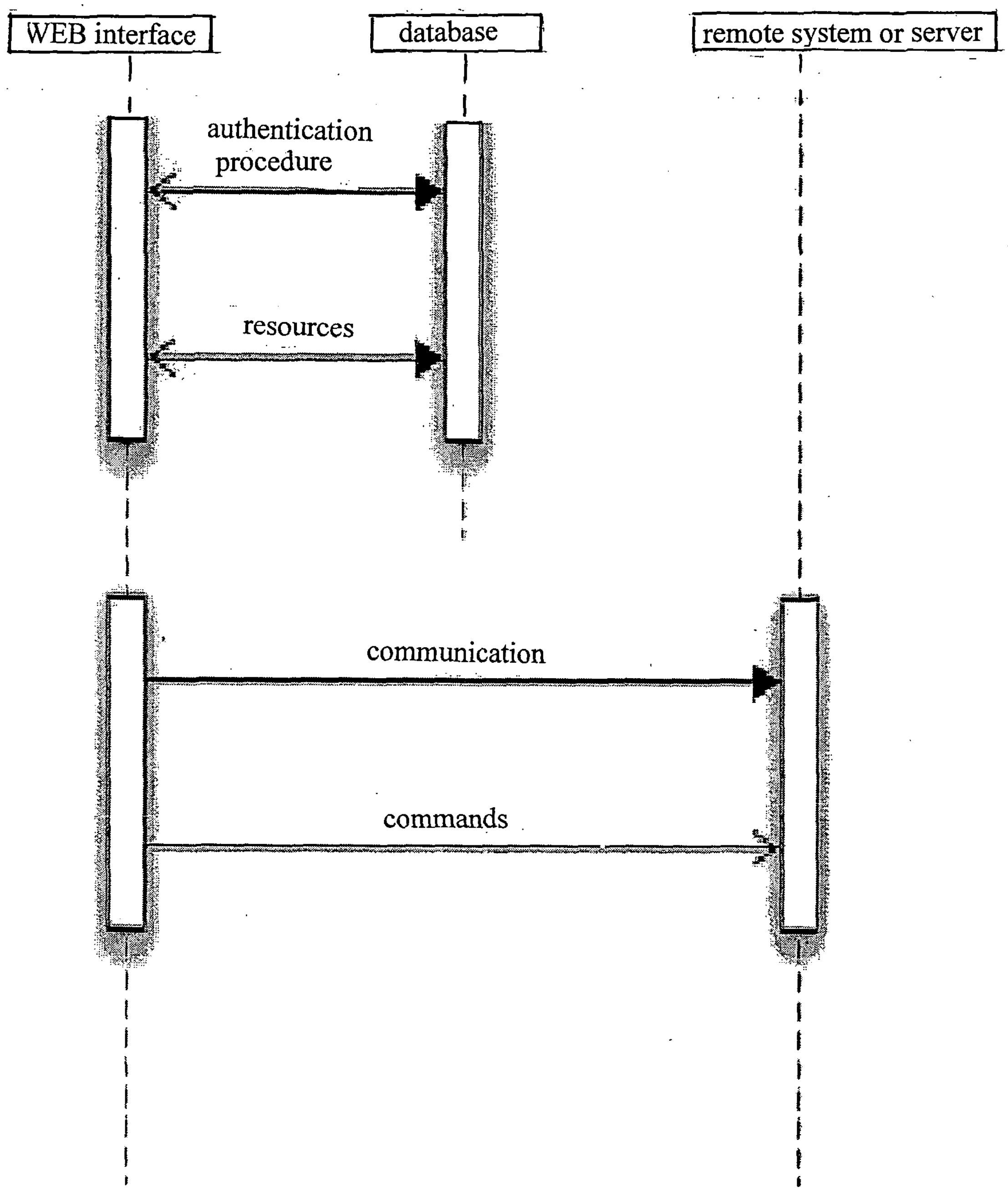
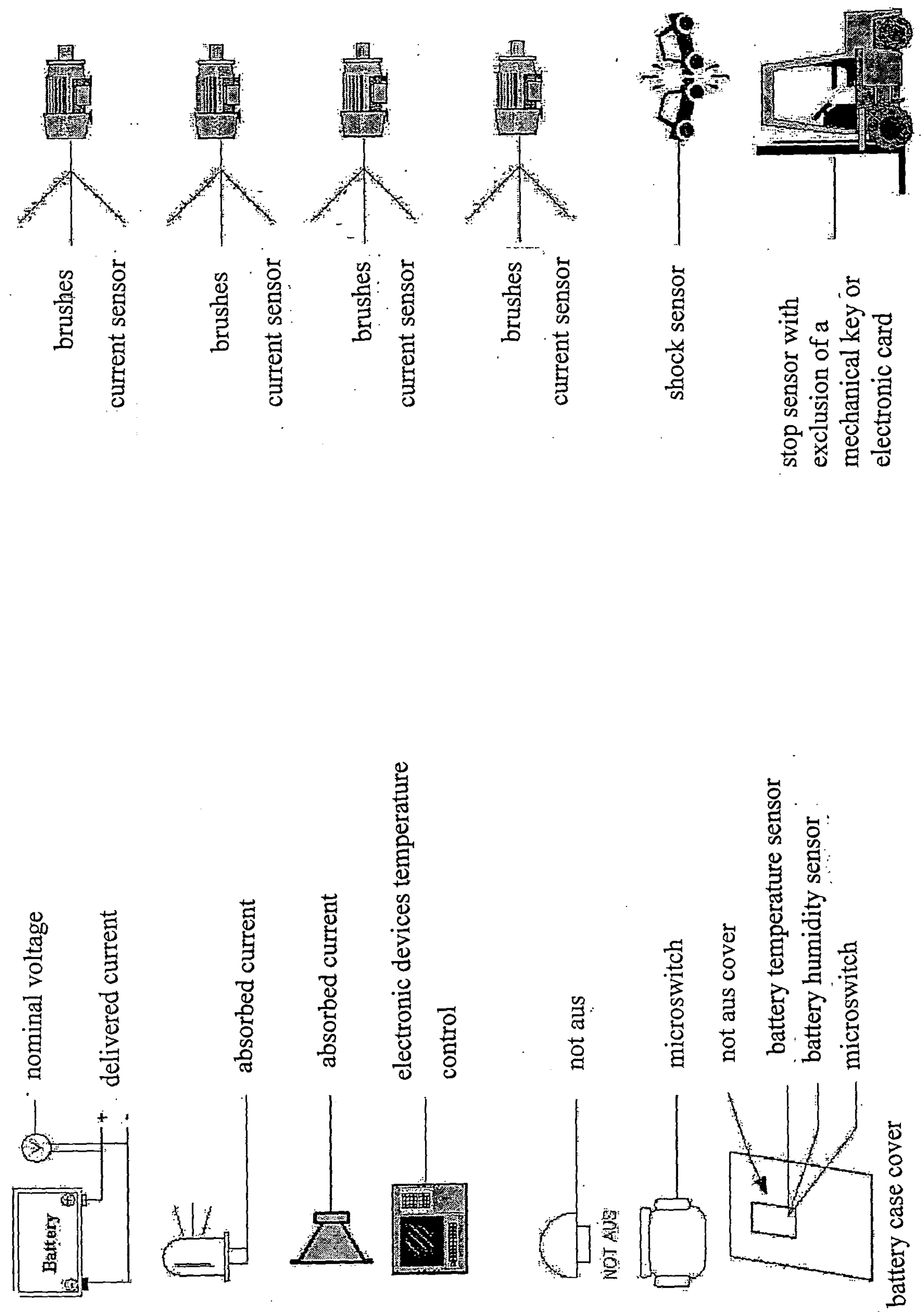

WEB interface
database
remote system or server
authentication procedure
resources
communication
commands

Fig.6



nominal voltage
delivered current
Battery
absorbed current
absorbed current
electronic devices temperature
control
not aus
NOT AUS
microswitch
not aus cover
battery temperature sensor
battery humidity sensor
microswitch
battery case cover
brushes
current sensor
brushes
current sensor
brushes
current sensor
brushes
current sensor
shock sensor
stop sensor with exclusion of a mechanical key or electronic card

Fig.7