Device installable in a vehicle for generating a rescue request and automatic sending of information on the geographical position of the vehicle

A device that can be installed on board a vehicle, for request for rescue and automatic sending of information on the geographical position of the vehicle comprises, in combination: GSM/GPRS communication means and corresponding antenna; means for receiving the signals of the GPS system and corresponding antenna; a crash sensor; handsfree communication means; at least one loudspeaker; at least one microphone; at least one pushbutton for manual calls; and electronic components necessary for supply and control.

Said GSM/GPRS communication means are designed to communicate with a purposely provided operating centre designed to provide the rescue service and/or for sending useful information.

FIG. 4B
Description

[0001] The present invention relates to the sector of motor vehicles, both for private use and for commercial or public use. More specifically, the invention regards an apparatus that can be easily installed on currently existing vehicles, which is designed to provide the occupants with the possibility of making a request for rescue for medical care and/or mechanical assistance, both upon command and automatically in the event of accident, providing autonomously all the identifier information regarding the vehicle and its position to a purposely provided operating centre.

State of the art

[0002] Many devices have existed for some time for location and transmission of information on the state of vehicles, which use satellite systems (GPS) for location of the vehicle, accelerometric systems for determining possible collisions of the vehicle, and wireless-communication systems (typically for cellphones, for example, GSM) for sending the data on the position of the vehicle and information on possible accidents.

[0003] Some of these also enable direct communication with the occupants of the vehicle, either on the initiative of a centre that provides the service or on the initiative of the occupants themselves, for requests for rescue or in general for handling emergencies.

[0004] In these known devices, handling of emergencies or rescue is typically a function accessory to other main functions, such as, for example: antitheft functions, functions of tracking or management of the vehicles, or else collection of data of interest for the insurance companies.

[0005] The European Community has launched a project, referred to as "e-call", having the purpose of determining European standards for sending warnings for rescue either automatically (determining any possible impact with accelerometric systems and in particular surveying the possible activation of airbag devices) and on the initiative of the occupants of the vehicle itself.

[0006] These standards cover both the data that have to be transmitted and their format and the phone numbers to which these data are to be sent, this to enable a uniform coverage of the service all over Europe.

[0007] In addition, starting from 2011 all the vehicles sold in Europe will have to afford said function as option on new vehicles. These standards in fact refer to a device supplied as original equipment, integrated in the electronic system of the automobile, which, by determining via activation of the airbag a possible collision and the position of the vehicle either by means of a GPS detector supplied standard (as is already occurring in the case of higher-range vehicles) or else by means of a detector specifically integrated in the device itself, will be able to forward a request for help which can be handled in all European countries.

[0008] Up to now, instead, no device is known specifically oriented to the safety of the occupants of the vehicle and devised for being applied on already existing vehicles that are not equipped with the European system described above, said vehicles being very numerous in so far as the device meeting the European standard, as has been said, will be available only optionally and starting from year 2011.

[0009] The main purpose of the present invention is hence to provide a device presenting the peculiarities listed below.

- It is easy to install: it is sufficient to connect the supply (+12 or +24 V) and apply the self-adhesive device in a convenient and stable position on the windscreen.
- It is all-inclusive: it poses no requirements on equipment of the vehicle, such as, for example, the presence of airbags, satellite navigator, handsfree system, or the like.
- It can be set in conditions of minimum consumption when the vehicle is not moving thus absorbing the minimum energy from the battery of the vehicle and hence not limiting the duration in the time when the vehicle is stationary.
- It can enable other authorized persons (for example, the parents of the occupants of the vehicle) to locate the vehicle at any moment (consider, for example, concerns linked to the phenomenon of "Saturday night out": it is possible to have the confirmation that the vehicle has not been involved in an accident and know exactly where it is).
- It is preferably provided with two pushbuttons, one for call for rescue, the other for providing services useful for the driver (information on traffic or on the state of the road and the weather).
- It can receive calls from the centre (which knows the position of the vehicle) for "proactive" services, whereby the centre issues an advance warning on any problems or risks that may be present on the road to be travelled along.
- It transmits the data both via the voice channel (guaranteeing a maximum time of 40 s for the response from the centre) and by means of SMS (this being a system that is more robust than the former even in areas with poor GSM coverage, albeit with times for delivery of the data that are longer and less certain). The device according to invention waits for confirmation from the centre of the data transmitted and repeats the event up to a maximum of three times in the case of lack of confirmation.
- It can provide the function of interactive Telepass with the operating centre in order to detect that the vehicle has passed through a toll gate to enter a motorway or exit therefrom in order to be able to provide specific services for
the user according to whether he is travelling on the motorway or on normal roads.

[0010] The above has been obtained, according to the invention, by providing a device that can be installed on board a vehicle, which is designed to enable the occupants to use the services for rescue provided by the operating centre with which it communicates, the device comprising: wireless phone means for communication with an operating centre for supply of information and/or for rescue, means for reception of GPS signals, handsfree communication means, and means for detecting whether the vehicle has suffered an accident.

[0011] According to a peculiar characteristic of the invention, the rescue services are requested:

- automatically (by means of an internal crash sensor) in the case of an accident that has some degree of seriousness;
- manually (by pressing the SOS pushbutton).

[0012] In both cases, the invention forwards a request for rescue to the operating centre.

[0013] A better understanding of the invention will be obtained from the ensuing detailed description and with reference to the figures of the attached drawings, which illustrate, purely by way of non-limiting example, some preferred embodiments and variants thereof.

[0014] In the drawings:

Figure 1A is a block diagram of a first embodiment of the device according to the present invention;
Figure 1B, which is similar to the previous one, is a more detailed block diagram;
Figure 2 shows the principle of operation of the present invention;
Figure 3 shows an example of embodiment of the device to be installed on board the vehicle;
Figures 4A and 4B, which are similar to Figure 1A and 1B, regard a second embodiment of the invention, which comprises the Telepass function;
Figure 5 shows a variant of the invention having a particular shape; and
Figure 6 shows the device of Figure 5 whilst it is being located in the passenger compartment of a vehicle.

[0015] According to the invention, the transmission of the request for rescue, whether it be automatic via crash sensors or manual via a first priority emergency pushbutton, initially regards sending of data: information is sent regarding the vehicle, its position, and the type of request (automatic in the case of an accident and/or manual via pushbutton). Immediately after, the communication passes onto the audio channel.

[0016] The operator of the operating centre is able to display the data sent and set up a telephone contact with the persons on board the vehicle. This enables verification of the conditions of the persons and agreement upon the procedure and type of rescue operation.

[0017] A battery integrated in the device guarantees operation of the apparatus even when, during the accident, the main battery of the vehicle has been destroyed.

[0018] The second pushbutton enables interaction with the centre for provision of services, for example information services (Figure 2).

[0019] Technical characteristics of an experimental prototype

| CASE: High-strength ABS; |
| GSM/GPRS MODULE: 4-BAND TELIT GE863-GPS. Phyton engine GPRS Class 10; |
| GPS MODULE: 20 fast-tracking channels, indoor navigation capability; |
| CRASH SENSOR: Tri-axial accelerometer with end-of-scale of 10 g; |
| VOICE COMMUNICAT.: Handsfree with integrated loudspeaker and microphone; |
| WARNINGS: Three LEDs and acoustic warnings for warnings directed to the user and diagnostics; |
| BACK-UP: Lithium back-up battery for guaranteeing operation for at least 15 minutes; |
| POWER SUPPLY: +10 V to +16 V, negative with respect to ground; protected in compliance with ISO 7637; |
| ABSORPTIONS: Normal operation: ~ 20 mA |
| ENCUMBRANCE (maximum): 135x70x30 mm (LxWxH); |
| TEMPERATURE: Operation in normal conditions: |
| POWER SUPPLY: +350 mA |
| Stand-by: ~ 3 mA; |
| -20°C; +60°C; |
| Operation in extreme conditions: |
| -30°C; +80°C; |
The device described, which can be installed on board an already existing vehicle, enables the driver and the passengers to use the rescue services, which will be provided by an operating centre with which it can communicate either automatically (following upon an accident) or manually (following upon operation of a purposely provided push-button).

The invention is designed to enable transmission of data and voice, preferably through a single channel. It is also possible to envisage operation through two separate channels, by providing a switch between the two channels that is sufficiently fast and reliable.

According to the invention, it is preferable for the GSM antenna and the GPS antenna to be integrated inside the device itself.

The fundamental requirements to guarantee use of the channels and forwarding of the warnings to the operating centre are:

- Guarantee of European roaming
- Use of the GSM/GPRS standard
- Practically simultaneous use of voice and data
- Safe mechanism of transport and routing

In the event of an accident involving the vehicle, the device according to the present invention forwards a request for rescue to the operating centre:

- automatically (by means of the internal crash sensor); or else
- manually (by the driver pressing a pushbutton).

As has already been mentioned, the transmission starts with sending of data comprising information on the vehicle, its position, and the data characterizing the accident.

Immediately after, the communication passes onto the audio channel.

The operating centre is then able to display the data sent and set up a contact with the driver so as to agree, where possible and necessary, upon the modes of rescue, and hence co-ordinate sending of rescue squads.

Figure 2 summarizes schematically the main functionalities of the invention.

With reference to Figure 1A, the device basically comprises:

- a GSM/GPRS communication module and corresponding antenna
- a module for receiving the signals of the GPS system and corresponding antenna
- a crash sensor
- a handsfree system
- a loudspeaker
- a microphone
- a pushbutton for manual calls
- a set of LEDs and buzzers
- a backup battery
- the necessary electronics for supply and control, preferably comprising a controller or microcontroller
- a second optional pushbutton, for providing information services.

According to a peculiar characteristic of the present invention, the device can be easily installed inside the passenger compartment of the vehicle. The pushbutton for manual calls, the warning LEDs, and the microphone are preferably provided in the front part, at the centre of the dashboard or in the proximity of the driver so as to facilitate the call operations.

The device according to the invention can be connected to the vehicle through two supply conductors of the vehicle (battery positive and negative), and possibly also via an optional conductor for supply of the instrument panel of
the vehicle.

[0032] It should be noted that it is preferable to envisage a backup battery for enabling sending of the data to the operating centre and dialogue with the operator of the centre, for at least 15 minutes, even in the case where, during the accident, the connection with the main battery of the vehicle fails.

[0033] The invention also comprises means for detection of the crash event. Said means are based simply upon control of the threshold of the value of the acceleration that the device (and hence the vehicle on which it is installed) undergoes. If the acceleration is greater than a pre-set threshold value (for example, $2g \sim 20 \text{ m/s}^2$), then a crash event is detected, which activates the communication with the operating centre.

[0034] Said communication with the operating centre, in the case of activation of the device, occurs preferably within 40 s, where said time is calculated starting from detection of the accident or pressure applied on the pushbutton of request for rescue.

[0035] Upon start of the call, the following data will be transferred to the operating centre:

- data regarding the call;
- data identifying the vehicle;
- data regarding the position of the vehicle.

[0036] The set of the data to be transferred to the centre has preferably the format indicated in Table 1 below.

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Name</th>
<th>Dim.</th>
<th>Type</th>
<th>Unit</th>
<th>Description</th>
</tr>
</thead>
</table>
| 1       | Control             | 1 byte  | Integer | M    | Bit 7: 1 = Automatic activation  
Bit 6: 1 = Manual activation  
Bit 5: 1 = Test call  
Bit 4: 1 = Invalid position  
Bit 3: SPARE  
Bit 2: SPARE  
Bit 1: SPARE  
Bit 0: SPARE |
| 2       | Vehicle identifier  | 20 bytes| String | M    | VIN according to ISO3779 |
| 3       | Time stamp          | 4 bytes | Integer | UTC sec | M | Timestamp of the accident event |
| 4       | Location            | 4 bytes | Integer | milliarcssec | M | Latitude position (WGS84)  
4 bytes | Integer | milliarcssec | M | Longitude position (WGS84) |
|         |                     | 1 byte  | Integer | degree | M | Travelling direction (based on the last 3 positions) |
| 5       | Service Provider    | 4 bytes | Integer | IPV4 | O | Service-Provider IP Address |
| 6       | Optional data       | 106 bytes| String | T.B.D. | O | Further data on accident event: e.g., characteristics of impact, position of vehicle, etc. |

M = Mandatory  
O = Optional

[0037] The total number of bytes to be transmitted in the worst case should not exceed 140 bytes.

[0038] As regards the position transmitted in the event of accident, this will be in any case the current position of the vehicle, even in the case where, on account, for example, of the vehicle turning over, the GPS data were no longer available. In this case, the not reliability of the position is signalled (bit 4 of the first data byte), and the last position detected in a valid way is transmitted within the Optional Data.

[0039] The pushbutton for sending a request for rescue has ample dimensions, and enables manual sending of calls. Preferably at least three LEDs are present for possible warnings to the user: both ones regarding the state of the device (including the GSM and GPS coverage) and ones regarding the state of the call in progress (Figure 3).

[0040] The invention is provided with handsfree communication means that enable the user to dialogue with the operating centre without having to use his or her hands and without having necessarily to approach the device itself.

[0041] Moreover present is a buzzer for signalling some information of major interest, such as, for example, a rescue
call having been sent, etc. Operation of the buzzer is preferably obtained by sending a tone on the loudspeaker of the handsfree device.

[0042] A second embodiment, shown in Figures 4A and 4B, differs from the first embodiment described so far substantially in that it comprises a Telepass module constituted by an integrated Telepass device connected to the microcontroller, preferably by means of a serial port.

[0043] The Telepass device is preferably supplied by an internal battery.

[0044] It should be noted that in this second embodiment of the invention, the presence of the integrated Telepass module is not simply a design choice that is limited to providing the Telepass function already supplied by known Telepasses, but enables provision of additional services that are possible precisely because the device is able to detect whether the vehicle is on a motorway and on which motorway. In addition, according to the stretch of motorway involved, the operating centre may manage a possible rescue request via the motorway network itself by sending a warning directly to the body responsible for motorway, without the user having to abandon the vehicle to reach the nearest SOS post.

[0045] Also the services for information on the traffic may be specialized to a significant extent using the information proper to the motorway network specific for the stretch of road travelled along and the direction in which the user is travelling, thus overcoming the current imprecisions of GPS.

[0046] A variant of the invention, shown in Figures 5 and 6, is characterized by a peculiar shape of the body of the device, which in this case is provided with a top curvature specifically studied to adapt it to the curvature of the various windscreens in the case where it is intended, as is preferable, to install it in contact with the top edge of the windshield.

[0047] In addition, the body of the device has two lateral flanges where the microphone and the loudspeaker of the handsfree device are respectively housed, which in this way are kept at a distance from one another, enabling a clear conversation preventing the Larsen effect even in a noisy environment (consider, for example, an accident occurring in bad weather conditions, people who are speaking aloud or are shouting, the radio that has remained on, etc.).

[0048] Moreover provided is a rear protuberance purposely studied for adapting to the different curvatures of the windshield, which, thanks to its limited horizontal extension, enables an excellent adherence maintaining the flanges at a distance from the windshield itself.

[0049] Said protuberances can be provided with appropriate means for engagement to a purposely provided slide that can be fixed to the vehicle, which enables the device to be rendered removable.

[0050] The pushbuttons are set in a position corresponding to the rear protuberance thus preventing the device from tilting when pressure is applied on the pushbuttons and providing, instead, an appropriate resting base when pressure is applied.

[0051] The present invention has been described and illustrated in preferred embodiments and variants thereof, but it is understood that functionally equivalent modifications and/or replacements may be made by any person skilled in the branch, without thereby departing from the sphere of protection of the present industrial patent right.

Claims

1. A device that can be installed on board a vehicle, for rescue request and automatic sending of information on the geographical position of the vehicle, said device being characterized in that it comprises, in combination:

   - GSM/GPRS communication means and corresponding antenna
   - means for receiving the signals of the GPS system and corresponding antenna
   - a crash sensor
   - handsfree communication means
   - at least one loudspeaker
   - at least one microphone
   - at least one pushbutton for manual calls
   - electronic components necessary for supply and control comprising at least one controller or microcontroller;

   said GSM/GPRS communication means being designed to communicate with a purposely provided operating centre designed to provide the rescue service and/or sending of useful information.

2. The device according to the preceding claim, characterized in that it further comprises one or more LEDs and/or a buzzer and/or a backup battery.

3. The device according to the preceding claim, characterized in that it is designed to be installed in the passenger compartment of a vehicle and to be connected to the electrical wiring system of the vehicle by means of at least two purposely provided cables: a supply cable (+12 or +24 V) and a cable that can be connected to ground.
4. The device according to the preceding claim, **characterized in that** it is provided with self-adhesive means for enabling installation thereof in a convenient and stable position on the windscreen.

5. The device according to Claim 1, **characterized in that** said control electronics is designed to modify its energy absorption when the vehicle is not travelling; thus obtaining limitation of the energy absorption by the battery of the vehicle.

6. The device according to Claim 1, **characterized in that** said control electronics is designed to enable location of the vehicle when it is stationary.

7. The device according to Claim 1, **characterized in that** it comprises two pushbuttons for manual calls: one for rescue calls and the other for providing services and/or useful information to the driver.

8. The device according to Claim 1, **characterized in that** said control electronics comprises means for receiving calls from the operating centre.

9. The device according to Claim 1, **characterized in that** said control electronics is designed to transmit the data both via the voice channel and by means of SMS, wait for confirmation by the operating centre of receipt of the data transmitted, make up to at least three attempts in the event of lack of confirmation.

10. The device according to Claim 1, **characterized in that** the rescue call starts with sending of data comprising information regarding the vehicle, its position and the data characterizing the accident, after which the communication passes onto the audio channel.

11. The device according to the preceding claim, **characterized in that** the total amount of bytes to be transmitted in the worst case is equal to or less than 140 bytes.

12. The device according to Claim 10, **characterized in that** the position transmitted in the case of accident is in any case the current position of the vehicle, even in the event where, on account for example of the vehicle turning over, the GPS data were no longer available; in said case there being signalled non-reliability of the position (bit 4 of the first data byte) and there being transmitted the last position detected in a valid way.

13. The device according to Claim 1, **characterized in that** it further comprises an integrated Telepass module, which is connected to the microcontroller via serial connection or other connection of a known type.

14. The device according to Claim 1, **characterized in that** it has a body provided with lateral flanges designed to keep it at an appropriate distance from the microphone and the loudspeaker of the handsfree device, enabling a clear conversation free from the Larsen effect even in noisy environment.

15. The device according to the preceding claim, **characterized in that** a rear protuberance is provided, purposely designed for adapting to the different curvatures of the windscreen and, thanks to its limited horizontal extension, for enabling an excellent adherence keeping the flaps at a distance from the windscreen itself.

16. The device according to the preceding claim, **characterized in that** said pushbuttons for manual calls are set in a position corresponding to the rear protuberance, thus preventing the device from tilting when pressure is applied on the pushbuttons and providing, instead, an appropriate resting base when pressure is applied.

17. The device according to Claim 1, **characterized in that** it has a body provided with a top curvature specifically designed to adapt it to the curvature of the various windscreens to facilitate installation thereof in contact with the top edge of the windscreen.