Title: SYSTEM AND METHOD TO TRAIN DRIVERS AND ENDORSE INFRACTIONS

Abstract: The present invention discloses a system and related methods to find, correct and endorse driver infractions; the proposed system an related methods receives continuously on a first communication link GPS ranging, compare calculated position with conformal regions previously generated on a reference surface, verifies limits are violated, starts a countdown of predefined span, issuing visual, acoustic and voice warning to the driver and thus waiting for driver changing driving attitude to satisfy conformal region limits and issuing a signal of predefined contents to allow penalty or fine emission in case no corrective action is performed by driver.
System and method to train drivers and endorse infractions

Description

FIELD OF THE INVENTION

The present invention relates to the field of training drivers find and endorse infractions committed by driving a motorized vehicle. The present invention also relates to the field of wireless communication of position and driving limits due to regulations. The present invention also relates to the field of exchanging and distributing data over a reconfigurable digital data network of moving and fixed nodes. More particularly, the present invention relates to a system and methods of interfacing navigational equipment, such as a Global Positioning System (GPS), wireless communication system with limited range (Bluetooth, WIFI, LPD), and mobile phone connection (General Packet Radio Service), digital data storage installed in a vehicle so that data from the navigational equipment and wireless networks can be used to compute and verify infractions and communicate both to the drivers and to an external system.

BACKGROUND OF THE INVENTION

Global Positioning Systems (GPS) are self-contained, portable systems that use transmissions from a number of orbiting satellites to determine their own location. It is even possible for a GPS unit to use earth fixed emitters (especially in cities and towns) where the sky is not directly visible and thus the pure positioning precision is reduced. A GPS unit can define its location in terms of latitude, longitude and radius anywhere in the world.

For obvious reasons, GPS units are commonly used in motorized vehicles: cars, trucks, buses, boats, ships, aircraft, motorcycles etc. With the information from an on-board GPS unit, and a review of how that information changes over time, a vehicle's direction or heading, velocity and other parameters can be determined. Additionally, other navigational equipment can be used to supplement the data generated by a GPS unit.

GPS units are also often integrated with an electronic mapping system. The mapping system may include a display system on which map of the user's locality is displayed. With the GPS data, the position of the user or the user's vehicle can be illustrated on the displayed map to assist a user in finding his or her way to a destination that is also mapped. The mapping system may also be able to generate directions or prompts based on a designated destination and the user's current location as identified by the GPS data.

While GPS units and related equipment help a user navigate
while in unfamiliar territory, the user can also stay in communication while roaming using a wireless telephone. Wireless telephones operate by transmitting radio frequency (RF) signals between the user's handset unit and a network of base stations distributed throughout a service area. These wireless networks, sometimes referred to as Wireless Wide-Area Networks (WWANs), can be used to transmit data as well as voice to and from the user's location.

GPS units position the vehicle with a certain error due to the number of satellites in view and to signal parameters. Usually a correction is operated by the software shifting the car position to the nearest electronic map track. It is sometimes used to increase accuracy in certain environments using a series of RF emitters, Bluetooth etc. to increase locally the accuracy in routes such as multiple lanes highway, exits etc. (see US 6,775,613)

Thus, GPS and other navigational equipment help a user to constantly identify his or her position and navigate to a desired destination.

Other than GPS, utilized to aid and facilitate the drivers, further systems are present and used to instruct drivers on the right behaviour in that position, they are usually traffic signs and electronic screens.

Driving vehicles implies the knowledge of vehicle behaviour, laws, regulations and the correlation between in-vehicle indicators, external signals and signalling systems (i.e. traffic lights), nowadays active systems are used instruct drivers according to their driving attitude in a classified way (see US 6,714,894). Recently active signals were introduced, they are able not only to give the visual indication but even an RF indication of the signal to be used remotely in vehicles to aid the drivers to foresee and to prevent potentially dangerous situations.

Actually an increasing number of crosses, streets and highways are controlled by vision system and digital camera to verify and measure the drivers behaviour or infractions, the infractions are registered and subsequently a ticket, fee or penalty is issued.

Systems are known that calculate speed using navigation system and compare speed with the speed of vehicle tachymeter generating a warning for the driver.

Other than GPS, signals, and in-vehicle sensors, wireless systems are used to receive and communicate events from the vehicle to inform drivers of traffic situations etc. or to
inform external systems about driver conditions (i.e. health conditions), driving conditions, etc.

GPRS are used to inform incoming cars about a incident, queue or heavy traffic condition.
Bluetooth or limited field RF system are used alternatively by bridging from one vehicle to the other to propagate such information.

This being the case, there is a need in the art for an improved means and method of using systems to reduce infractions and thus to reduce potential lethal events, there is a need to reduce driving mortal accidents guiding drivers community to drive safely and well informed in an autonomous and constant way, pursuing any deviance from this behaviour, there is a need of integrating GPS, wireless communication systems, signals so as to guide drivers to respect limitations, to find infractions and to allow drive attitude to change; to issue penalty or produce automatic issuing of fines in case of wrong persistent driving.

SUMMARY OF THE INVENTION

The present invention meets the above-described needs and others. Specifically, the present invention provides an improved means and method of integrating GPS, limited range RF communication, wireless communication systems, and limits information database in order to assess infractions, request to the driver a correction and in case of infraction persistence communicate contextually to the penalty or fine.

Additional advantages and novel features of the invention will be set forth in the description which follows or may be learned by those skilled in the art through reading these materials or practicing the invention. The advantages of the invention may be achieved through the means recited in the attached claims.

The present invention may be embodied and described as a display unit for a vehicle (Fig.1) having: a microprocessor unit; a GPS receiver; a limited RF transmitter (i.e. Bluetooth); a GPRS (or UMTS) data transmitter; a limit database installed in the system; a bus interface connecting the GPS receiver and the limited RF transmitter.

Different tasks are performed by the system simultaneously. The GPS receiver outputs navigational data to the microprocessor. The navigational data are stored together with the average speed to built an history log of a definable length.
The system calculates condition and if a limit is exceeded a warning is produced and a time/space counter start a "countdown" to determine time for issue of infraction.

When the elapsed time reaches a preset value the driver is penalized according to the local regulation and norms by issuing a fine and/or reducing its licence points/score.

The function to communicate the fine or penalty, to communicate dangerous events or occurrence identified according to the herein mentioned method and systems, are performed via a GPRS module or similar (like reduced engine data exchange modules).

The RF transmitter (RF-card CPU) check for other RF transmitters of the same type (i.e. vehicles) and outputs local speed, position and time. Same system receive or creates a vehicle identification code. According to well known 802.15 IEEE standards for wireless LANs or similar a dynamic network could be established between vehicles moving in the area and data concerning position, speed and time could be exchanged between vehicles. System CPU calculates continuously updating a memory list of differences in position, speed and times fore each vehicle.

A proper programmed function check for those differences and performs logical operations to understand if some limits, special condition (traffic jam) or dangerous conditions (incidents and accidents) occurs in that area or if a potential dangerous condition is taking place due to the vehicle interactions.

The positioning of vehicle can be increased in accuracy using special functions like DGPS that calculates using accelerometer, speed sensors, wheel etc. a correction to the GPS position. Error sources such as satellite clock bias, atmosphere delays, orbit bias produce apparent position shifting on the geoids. Since the goal is to have a resolution relative to vehicle position the correction made by such algorithm is enough to discriminate mutual position of the vehicles. (see as example the article of Fenglin Guo, Yuehong Ji and Guorong Hu3 "Methods for Improving the Accuracy and Reliability of Vehicle-borne GPS Intelligence Navigation").

The data are elaborated by the CPU and result of the elaboration is shown to the drivers as symbols enlighten on a panel (Fig. 2) such as "speed limit", "one way", "wrong side surpassing" etc. As further example and embodiment of the present method in case some off limits area is entered by vehicle proper symbols are also activated via the wireless local LAN functionality (or using GPS system and limits database if resolution is commensurable with that area).
The present invention also encompasses an embodiment that combines these six systems. Thus, the present invention may be embodied as a navigational system, a radiofrequency wireless local LAN that includes the vehicle, a data transmitting systems that connect vehicle to a WAN network, a route accuracy increasing system to increase inter-vehicle positioning info and a system to display symbolically limits and violations. Data received form the GPS, the wireless network are transmitted to the CPU and compared; result is displayed symbolically to the drivers; system waits for driver actions - if it is the case; the system issue data and signal via symbols in case of drivers not changing its attitude.

The present invention also encompasses an embodiment that combines three of abovementioned system in a single system or by activating three of the six above-mentioned systems. The present invention also encompasses a method of providing drivers education by connecting a GPS receiver, a wireless local LAN for inter-vehicular data exchange, a symbolic visualization system.

The present invention also encompasses an embodiment that combines four of abovementioned system in a single system or by activating four of the six above-mentioned systems. The present invention also encompasses a method to correct drivers attitude by connecting a GPS receiver, a wireless local LAN for inter-vehicular data exchange, a symbolic visualization system and a data exchange WAN system.

The present invention also encompasses an embodiment that combines four of abovementioned system in a single system or by activating four of the six above-mentioned systems. The present invention also encompasses a method to signal potential dangerous occurrence since traffic jams, incidents and accidents etc. by connecting a GPS receiver, a wireless local LAN for inter-vehicular data exchange, a symbolic visualization system and a data exchange WAN system.

The present invention also encompasses an embodiment that combines three of abovementioned system in a single system or by activating three of the six above-mentioned systems. The present invention also encompasses a method to pay fees such as passage rights or parking rights by connecting a GPS receiver or in alternative a wireless local LAN for extra-vehicular data exchange a data exchange WAN system.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings illustrate preferred embodiments of the present invention and are a part of the specification.
Together with the following description, the drawings demonstrate and explain the principles of the present invention.

Fig. 1 represents one of a plurality of conditions that involves a vehicle (7a) travelling along a route (2) (street, road, highway etc.) placed on the hearth surface (1). Usually the GPS returns a geoids position of the vehicle (7c) on an ideal surface (6). The vehicle position is transformed by using a digital map of the average earth surface (3) having the route boundary (4) necessary to correct the translated position of the vehicle (7b).

The present method uses a conformal mapping of a limits area, expressing a condition to be satisfied directly on the geoids surface or even an arbitrary surface having the property of reducing computations at a minimum. Several different areas (6) are represented on that surface including the route projection (5). It is not necessary for the use of the present method to calculate the projected route since only the position (7c) of the vehicle and the conformal region representing the limits are needed. Several other disjoint or overlapping regions are also represented for multiple limits such as speed limit and direction limits (i.e. one way routes) in different colors (6).

Fig. 2 represents two of the basic systems used to train, advise and even penalize the drivers. Both systems 20 and 30 have an area devoted to visual signal (13) and an area devoted to acoustic/voice signal (12). In the visualization area (13), it is represented a limit violation visualization by means of a proper shaped and coloured light (11) being switched on for the limit under violation.

Fig. 3 is a block diagram illustrating an example system architecture to implement the hereinafter described system and methods.

The system has four levels:
level 0 represents the function of computing conditions and autonomous sensing vehicle attitude,
level 1 is the communication layer that exchange data and parameter with the level 0,
level 2 is the outer layer that includes ones of a plurality of satellites, one of a plurality of vehicles and ones of a plurality of communication networks/systems.
Level 3 is the level of precompiled conditions and parameters used as comparison term for the system and stored in a proper sub-system memory.

Throughout the drawings, identical elements are designated by identical reference numbers.
DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

As used herein and in the appended claims the definition of "conformal region" will be used; the region is a surface area identified by a perimeter on the earth surface projected on a reference geometry of arbitrary concave shape representing a conformal hearth surface representation. As specific example intended as not limiting the generality of the application is a sphere with average hearth radius or the geoids defined according to the chosen satellite networks.

The present invention provides an improved means and method of integrating GPS and wireless communication systems together with the drivers attitude and behavior so as to make the GPS and wireless communication systems more readily and safely usable to avoid incident and potential dangerous driving situations. GPS and data from other navigational equipment is used for performing continuously travelling condition computation and checking through these data if some limits or regulatory condition is violated. Data streams sent to, and received from, wireless networks operating in the area, e.g., a WWAN, WLAN or WPAN, could be also visualized through the example visualization system (Fig.2).

Using the drawings, the preferred embodiments of the present invention will now be explained.

Vehicles represent a particular environment in which navigational data, wireless communications and driving behaviour are blended by human control capability. Often these capabilities are reduced by physical or health conditions or even by global community habits. Especially global community habit change for a limited time produce regulation violation, this leads to accidents and incidents. The proposed system supporting the herein disclosed method, performs the function to establish and allowing drivers enhanced self-check of correctness. This evidently due to the nature of local signs and indication is not easy viable. As will be understood, the term "vehicle" as used herein, and in the appended claims, encompasses all forms of motorized transportation, including, but not limited to, cars, vans, trucks, buses, sport-utility vehicles, airplanes, aircraft, boats, ships and the like.

The system delivering the functions useful and necessary to implement the method are described in the following.
A GPS module (level 1 Fig.3) receive a signal from the satellite network at characteristic frequency as example a typical frequency is a signal at 1575 MHz via an IF of 20MHz to an output frequency of 4MHz suitable CPU processing. The system could use an external reference oscillator to generate both RF local oscillator signals and the processor reference clock, this allows to coordinate computation level to the different data stream incoming.

A CPU module (level 0 Fig. 3) as well known in the field has microprocessor style peripherals added on-chip. In the realized system is incorporated as example a DSP hardware for processing the signals from GPS (Global Positioning System) satellites. A twelve channel GPS correlation DSP hardware is designed to handle twelve satellites, two of which can be initialized to support the RTCA-SC159 specification for WAAS (Wide Area Augmentation Service) and EGNOS (European Geostationary Navigation Overlay System) services. The chosen CPU for the purpose of the realization has hardware DSP and microprocessor functions on one chip together with on-chip RAM and ROM.

An inertial sensor (level 0 Fig. 3) module such as a tri-axis digital output linear accelerometer that includes a sensing element and an IC interface able to take the information from the sensing element and to provide the measured acceleration signals to the CPU module through an I2C (or SPI) external world through an I2C/SPI serial interface. The data rate at the output of the accelerometer is used directly for integrating the position and speed between route reconstruction points in the conformal area. A typical value for the signal frequency to 4.48 KHz.

A transceiver module (level 1 Fig.3) has chosen and implemented (PA+antenna switch functions) to build a complete triple-band solution from antenna to base band interface. The embodied example as realized addressing the European regulation, but even US regulation is nowadays easily implemented at the same level. In Europe suitable standards are nowadays EGSM900, DCS1800, and PCS1900 bands while in United States GSM850, DCS1800, and PCS1900 bands.

A wireless LAN RF transceiver module (level 1 Fig.3) is used able to transmit in standards bands such as 2.4GHz and 5GHz: usually the transmission could be compliant with 802 Standards. The transceiver is bidirectional and could communicate from/to a plurality of vehicles within the transmitting radius, exchanging data such as position, average speed, time etc.

As shown in Fig. 1, the present invention preferably includes an antenna placed on the vehicle (7a). The antenna preferably
is connected to a GPS receiver. As noted above, this GPS receiver receives transmissions from a number of orbiting satellites via the antenna while travelling on the road (2). The road lays on the hearth surface (1) that has altitude variations (valleys, mountains etc.) and area not covered by satellite signals (tunnels etc.). While the vehicle is travelling the system searches an internal n-dimensional database through the well known independent parameters relates to the absolute GPS coordinates. It is even possible for the method of the presented invention to use two coordinates only since the system does not need for a physical representation but only of a conformal development of areas on a reference surface. The database interval contains information describing the type of limits for the area enclosing the vehicle transformed position (7c) at area and the value assumed by the limits. For more fast response once the position has identified it is possible to choose and implement a strategy of position proximity position to the vehicle to be read and kept in RAM (Level 0 Fig.3) to speed up CPU computations. When vehicle conformal position (7c) is identified inside an area a condition is found for the entry, the CPU activate a process to check if the limit (6) is violated or not.

The meaning of the limits is depicted in the Fig.1 where conformal areas (6) lay on the reference surface (5). The colour of each area (6) represents a different type of limit/limit value couple. It is not useful for the scope of the present invention to calculate the projection of the conformal areas, but even to use the original untransformed coordinates and to transform the vehicle position not on the average normalized earth radius (7b), but one the reference surface itself (7c). With this transformation it is not necessary to know the road, park etc. conformation precisely in almost a great part of positions since a larger area could be attributed with this limitations. It is possible also to have multiple limitations overlapping such as a speed limits and a no parking condition (i.e. typical situation for towns and cities).

From a regulatory point of view the disclose method, is greatly safe in choosing penalty of fine condition issue since a great tollerance is used to calculate the violation and thus found violation are more certain than human judged ones.

When the GPS signal are low or incomplete since sky is not visible or partially visible, the accelerometer is used to integrate position, speed etc. When the GPS signal come again to full intensity or complete satellite set, the system updates the position/speed information.
Speed is calculated as average speed on a set of position and time values stored in a dedicated memory portion, the number of point for speed averaging could be variable with vehicle, area etc.. If the system cannot use the GPS and switch on accelerometer, the calculation algorithm is changed and points are stored from acceleration to speed and then to position in a reverse calculation method. In case of excessive mismatch between accelerometer and GPS position a corrective procedure and special check is activate recomputing the backlog point list.

According to the abovementioned embodiment of the system a multiple array of time, position and speed is readily available for the purpose of present process for the use of another portion of the system. This second portion continuously updates actual limits condition and consequently activate the relative part of the system controls to check the value of the limit, CPU (Fig.3 level 0) and dynamic/attitude DB (Fig.3 level 3) are used intensively in such a portion of the process.

As example from the position a limit S is a speed limit and a value of 90 km/h is the value the database contains as info such as S90 valid for this coordinates. In the same area could be present a limit involving on-way with direction E (from standard relative notation on the surface S,N,E,W,S-E,N-E etc.) involving a database representation as -E (one way opposite to positive direction).

The system check from the actual position the values of speed and direction of movement, if the speed is exceeded (i.e. vehicle speed is greater than 90km/h) a time counter is started and contemporarily an acoustic and visual signal is issued to the drivers by the use of systems such as those represented in Fig. 2a and Fig. 2b.

The system allows two action for the driver, to reduce the speed and thus disabling the time counter or to ignore the advise and instruction and to leave the time counter grow the elapsed time.

In case of speed reduction, the elapsed time counter is not increased and after a certain period is initialized to zero (i.e. 4-5 minutes).

In case of speed maintenance or speed increase and reaching a maximum allowed value for elapsed time a signal is issued to the driver and a third portion of the system is activated for the notification process. The CPU activate the GPRS module to issue a communication of the violation to an external receiving RF network or wireless phone bridge. The information are then delivered to a system dedicated to the issuing of fines and/or financial transaction. The transactions could also lead to the issuing of communication of penalty using existing communication channels and according to regulations. Continuing the example, in case the
vehicle is moving with the correct speed below the limit indicated by S90 and the calculated movement is according to the flag E, the limit violation condition is calculated. This case is of different nature since the potential danger at a maximum level for this violation and the warning is notified and after few second the notification is issued according to the above describe procedure for violation notification.

The corrective action induced in the drivers attitude is thus not of endorsement or even repressive nature but of self-training type.

The presented use with the conformal limit area mapping is not the only one for the disclosed system. It is also possible to collect and compute data for the self-correction and notification of infractions not related to places only such as those involving more than on vehicles, as example the wrong side surpassing manoeuvre could be easily identified by using same data collected and generated for speed and position according to the above mentioned methods and then transmitted through the wireless (es. WIFI module, Bluetooth). Using such a transmission channel it is possible to transmit position and speed data. The data could be received from other vehicles as a broadcast transmission and sorted by distance (i.e. position) and the position and speed condition could be controlled by any of the vehicles.

If the vehicle transits in an area were right-side surpassing (for right side driving) the relative speed and the position is checked together with the advancement direction producing, in case of limit violation, the notification procedure to be activated.

The system used for the purpose of described method, uses a simple broadcast transmission method with minimal protocol to reduce communication establishment procedure. The use of local existing RF references and even the accelerometer could be used to increase the positioning.

The presented process is performed by the disclosed system through visual and acoustic signal. The system used to communicate visual signals and to emit acoustic signal or electronic voice warnings are represented in Fig.3. The notification action produces the enlighten of a proper signal with fixed or pulsating light with the shape of the violated limit signs (Fig.2a). In an other embodiment the symbols are represented on a display (Fig.2b). The disclosed devices, as represented in Fig. 2 could take care autonomously of the signal in case of incident. In case of accident the system has an activating button and proper internal batteries (Level 0 Fig. 3) toi allow a specific GPRS signal ans local area network signal to be transmitted to allow remote and local identification and rescue process to be activated.

The presence of each of the components, integrated in a single systems, activates other functionalities, described in
the following. All these functionalities are directly obtainable by the vehicle GPS position and with the signal of other surrounding vehicle GPS position by simple position and speed differences checking process, the accuracy is enough precise for highways and roads (usually within 10-15 meters), for streets the use of integration with accelerometer or DGPS could be used to increase accuracy up to 5-8 meters.

Reassuring the major limitation and instruction that the disclosed system and method could deliver to the vehicle drivers in order to allow driver itself to change the driving attitude and turn to a correct behaviour. The function described below are an example of the system capability to deliver different condition combinations using the disclosed method and systems to reduce effectively by prevention the drivers potential failures.

The average speed is computed using GPS data or integrating GPS with inertial information on a defined time interval to assess without any doubt that the speed limit is exceeded; average speed is thus more precise in defining a limit violation than the usual instantaneous speed. A first example functionality concerns the safety distance between vehicle. This is one of the major source of incidents and accidents, since it grows with speed it is possible to compute with great affordability by the difference in position transmitted by the vehicles through the RF local area network link in broadcast mode. Data are compared for vehicles moving in same direction with lowering distance; a set of few position could also be transmitted in that case to allow to exactly check by a fast comparing procedure if the two vehicles are following the same route within a predefined tolerance.

A second example functionality concerns the case of incident the system could issue a special signal, trough the RF local area network while issuing contemporarily a GPR SMS or digital data for the incident signalling. The function operates also as a emergency activated push button in this case it has a lower level of dangerousness and is equivalent to standard warning signals delivered to others drivers in view through direction indicators. A further example functionality concerns the source of incidents and accidents is the case of sudden turns; high acceleration occurs as example when cars trajectory is wrong and the drivers correct abruptly the direction could be detected and registered. Since his situations happens usually when the driver is drunk, tired etc. or the street adherence is low, after a pre-defined number of occurrence the speed limit is reduced by a significative factor to suggest driver to guide slowly and safely.
A further example functionality concerns the drivers physical effort and level of attention required to drive. A time counter measures the elapsed time and when the driver reaches the maximum allowed continuative time a warning signal is issued and the suggestion of stopping and restoration is issued. When the drivers stops for a certain period the counter resets. In case different drivers share a vehicle the function could be activated or counter initialized by a proper electronic signal such those produced by drive license cards having RFID, smart card or magnetic reading.

A further example functionality concerns the transit/stopping through cities border or in town areas. Nowadays to enter by car in city centres a fee has instituted, fees could be automatically recognized by the disclosed system and method and the notification procedure is started. Since the system has a GPRS channel, a proper SMS or data could charge the value to the system memory in a predefined area. When a vehicle stops and is stationary in a parking area, the system counts the time at fixed position and bills by the same abovementioned method the vehicle proprietary.

A further example functionality concerns the memorization of relevant information. In case of incident, since the system memorize in the live stack memory positions a certain number of positions, speeds etc. it is possible to retrieve those information after incident or malfunctioning in order to reconstruct the previous events.

A further example functionality concerns the use of accelerometer allows to sense for excessive horizontal acceleration, according to the well now behaviour of the air bag accelerometer, producing in case of excessive acceleration (such as during incidents and accidents etc.) and then a fixed position, the immediate notification through any of the output channel of an emergency code.

A further examples functionality concerns the use of personal local area network to check for the presence and operability of the system by a transponder functionality. The fixed point is activated by a signal such as variation of magnetic wire flux, photocell interruption, laser beam etc.; an emitter thus emits a signal expecting the vehicle signal back. If the signal is not sent back the system activate alarms and could even took the vehicle picture.

For the purpose of the exact notification for a foreign driver, the GPRS module is coupled to the vehicle serials or to the vehicle signs.

The preferred embodiment was chosen and described in order to best explain the principles of the invention and its practical application. The preceding description is intended to enable others skilled in the art to best utilize the invention in various embodiments and with various modifications as are suited to the particular use contemplated. It is intended that the scope of the invention be defined by the following claims.
Claims

1. A computer controlled driver training and infraction endorsement method comprising the acts of:
   receiving continuously from a network of satellites on a first communication link at one of a plurality of vehicles GPS ranging signals for initially accurately determining the one vehicle's position;
   comparing such a calculated position with a plurality of conformal regions previously generated by conformal models as laying on a reference surface;
   verifying if at least one of a plurality of limits conditions valid inside the conformal region is violated and for each condition starting a countdown of predefined span, issuing visual, acoustic and voice warning to the driver and thus waiting for driver changing driving attitude to satisfy conformal region limits;
   activating an output link of wireless or local nature in case elapsed time for any of a plurality limit violation is exceeded and transmitting using the one of a plurality of fine.

2. A process according to claim 1. were the reference surface is the satellites predefined geoids.

3. A computer controlled driver training and infraction endorsement method comprising the acts of:
   receiving continuously from a network of satellites on a first communication link at one of a plurality of vehicles GPS ranging signals for initially accurately determining the one vehicle's position in a conformal region relative to surface of the earth;
   storing at one of a plurality of vehicles in a proper memory area the position, including the use of such position table at different times to calculate the one of a plurality of vehicles speed, including the integration of the propagation errors of GPS position and calculate speed due to delays by the integration of included accelerometer signal;
   associating continuously the one of a plurality of limit conditions to the vehicle speed and position based on the persistence of vehicle position in one specific of the plurality of conformal region having limit specified inside;
   identifying any of a plurality of limit condition violation and for each condition starting a countdown of predefined
span, issuing visual, acoustic and voice warning, to the driver and thus waiting for driver changing driving attitude to satisfy conformal region limits;

activating an output link of wireless or local nature in case elapsed time for any of a plurality limit violation is exceeded and transmitting using the one of a plurality of fine.

4. A computer controlled driver training and infraction endorsement method comprising the acts of:

receiving continuously from a network of satellites on a first communication link at one of a plurality of vehicles GPS ranging signals for initially accurately determining the one vehicle's position in a conformal region relative to surface of the earth;

storing at one of a plurality of vehicles in a proper memory area the position, including the use of such position table at different times to calculate the one of a plurality of vehicles speed, including the integration of the propagation errors of GPS position and calculate speed due to delays by the integration of included accelerometer signal;

establishing connection with a plurality of a vehicles receiving and storing a plurality of data sets containing vehicles position, speed and special events;

comparing continuously position, speed and signalled events of vehicle and a the plurality of vehicles data identifying any of a plurality of limit condition violation and for each condition starting a countdown of predefined span, issuing visual, acoustic and voice warning, to the driver and thus waiting for driver changing driving attitude to satisfy conformal region limits;

activating an output link of wireless or local nature in case elapsed time for any of a plurality limit violation is exceeded and transmitting using the one of a plurality of fine.

4. A method according to claim 1,3,4 where the limits condition for the safety distance is computed through the acts of:

computing trajectory of a the vehicle using at least a vehicle position;

receiving from one of a plurality of vehicles in the transmitting range at least a position and time;
computing the safety distance using the above mentioned positions.

5. A method according to claim 1, 3, 4 where a incident condition limit is computed through the acts of:

measuring acceleration through the accelerometer;

computing continuously the difference between measured acceleration module and a predefined limit;

verifying the excess of acceleration and starting counting elapsed time from that condition.

6. A method according to claim 1, 3, 4 where a sudden turn condition limit is computed through the acts of:

measuring lateral acceleration through the accelerometer;

computing continuously the difference between measured lateral acceleration module and a predefined limit;

verifying the excess of acceleration and starting counting number of corrections;

computing continuously the exceeding of a limit number of correction.

7. A method according to claim 1, 3, 4 where a driving time limit condition is computed through the acts of:

verifying the present vehicle position is changed from the previous vehicle position,

computing the time difference and summing the elapsed time to a time counter,

verifying continuously the time counter does not exceed a predefined limit;

zeroing the time counter if the present vehicle position is the same for a predefined time interval.

8. A method according to claim 1, 3, 4 where a stationary condition is computed through the acts of:

verifying the vehicle position is within a stationary conformal area;

computing continuously the time elapsed in permanent position;
subtracting from a predefined credit value stored in a memory position the proper time based fee;

computing continuously the credit value residual,

9. A method according to claim 1,3,4 where an exception operating condition limit is computed through the acts of:

receiving special local signal through one of a plurality of frequency received by GPS system;

comparing signal and activating a transmitting sequence back to source.

10. A method according to claim 9 where the receiving special local signal through one of a plurality of frequency is received by radiofrequency local area network module.

11. A driving limits modelling method comprising the acts of:

identifying one of a plurality of geographic areas;

identifying a one of a proper reference surfaces with a point to point relation with the geographic areas;

identifying one of plurality of limits valid in said geographic area;

attributing one of a plurality of limit parameters to said conformal surface;

storing one of a plurality of conformal surface definition and limit parameters in a proper database.

12. A system to train driver and endorse infractions comprising:

a GPS module for accurately determining the one vehicle’s position,

a memory module storing a plurality of conformal region and limit parameters information,

a computer processing unit computing limit violation and verifying driving corrections,

a visual and acoustic module to issue signals to the driver,

a GPRS module for transmitting violation data.

13. A system to train driver and endorse infractions comprising:
a GPS module for accurately determining the one vehicle’s position,

a radiofrequency module to exchange position, speed and time, between vehicles,

a memory module storing said position, speed and time,

a memory module storing a plurality of conformal region and limit parameters information,

a computer processing unit computing limit violation and verifying driving corrections,

a visual and acoustic module to issue signals to the driver,

a GPRS module for transmitting violation data.

14. A system to train driver and endorse infractions according to claims 12, 13 including:

a GPS module for initially accurately determining the one vehicle’s position,

an accelerometer to integrate the present position from said initial position.
**A. CLASSIFICATION OF SUBJECT MATTER**

IPC 7  G09B19/16  G08G1/052

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)

IPC 7  G09B  G08G

 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, PAJ, COMPENDEX, INSPEC, IBM-TDB

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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**Date of the actual completion of the international search**

18 July 2005

**Date of mailing of the international search report**

29/07/2005

**Name and mailing address of the ISA**

European Patent Office, P.B. 5318 Patentlaan 2 NL - 2280 HJ Rijswijk
Tel: (+31-70) 340-2040, Fax: (+31-70) 340-3016

Authorized officer

Gabriel, C
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