



- (51) International Patent Classification:
B60W 30/14 (2006.01)
- (21) International Application Number:
PCT/IN2012/000131
- (22) International Filing Date:
27 February 2012 (27.02.2012)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
624/CHE/2011 2 March 2011 (02.03.2011) IN
- (72) Inventor; and
- (71) Applicant : NOBY ERALIL ABI [IN/IN]; Eralil House,
LPS Road, Pallinada, Palarivattom, P.O., Kochi- 682025,
Kerala (IN).
- (74) Agent: PRABHU, Rudresh; #74,3rd Floor, 2nd Main, 3rd
Cross, East of Kathriguppa, Banashankari 3rd Stage, 4th
Phase Bangalore-560085, Karnataka (IN).
- (81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,

AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ,
CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO,
DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN,
HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR,
KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME,
MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ,
OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD,
SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR,
TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

- (84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ,
UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU,
TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE,
DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,
LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,
SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— of inventorship (Rule 4.17(iv))

[Continued on next page]

- (54) Title: SYSTEM AND METHOD FOR REGULATING VEHICLE SPEED

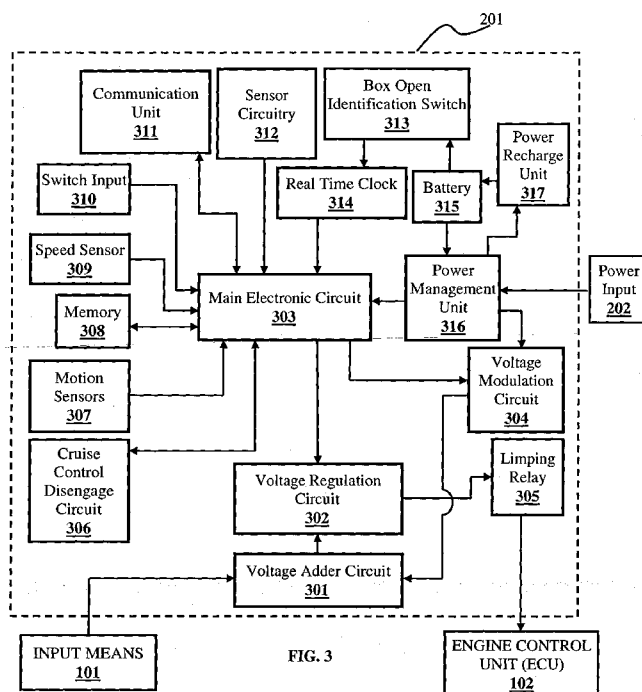


FIG. 3

(57) Abstract: The various embodiments of the present invention provide a system and method for regulating a vehicle speed within a preset speed limit. The speed regulating system comprising a memory unit to store a pre-set vehicle speed, a speed set means to update the pre-set vehicle speed, an input means to provide a voltage input, a power management unit, a main electronic circuit to control and coordinate the components of the speed regulating system, a sensor circuitry to detect and transmit data to the main electronic circuit, a voltage modulation circuit to modulate a voltage from the power management unit, a voltage adder circuit to generate an output voltage, a voltage regulation circuit to regulate the output voltage and a limping relay to alternate supply of the output voltage to the Vehicle Engine Control. The main electronic circuit controls the vehicle speed based on one or more pre-determined speed regulatory factors.



Published:

- *without international search report and to be republished
upon receipt of that report (Rule 48.2(g))*

FORM 2

The Patents Act 1970

(39 of 1970)

&

The Patent Rules 2003

COMPLETE SPECIFICATION

(See Section 10 and rule 13)

TITLE OF THE INVENTION:

SYSTEM AND METHOD FOR REGULATING VEHICLE SPEED

APPLICANT

Noby Eralil Abi

**Eralil House, LPS Road, Pallinada,
Palarivattom P.O, Kochi-682025, Kerala**

PREAMBLE OF THE DESCRIPTION:

**THE FOLLOWING SPECIFICATION PARTICULARLY DESCRIBES THE
INVENTION AND THE MANNER IN WHICH IT IS TO BE PERFORMED**

This Non-provisional patent application claims the priority of the provisional patent application numbered 624/CHE/2011 filed on 2nd March, 2011.

A) TECHNICAL FIELD

[0001] The present invention generally relates to vehicle speed management systems and methods, and particularly relates to a system and method for automatically limiting the speed of the vehicle dynamically within a pre-determined speed level, regulating the speed of the vehicle between a maximum pre-determined speed limit and a minimum pre-determined speed limit for acceleration control and to maintain the speed of the vehicle at a pre-determined speed limit regardless of the driver's operation on the accelerator pedal.

B) BACKGROUND OF THE INVENTION

[0002] In recent years, constant efforts have been deployed to develop various automatic and semi-automatic mechanical speed controllers for motor vehicles. The primary aim of the speed controllers is to limit the maximum speed of the vehicle within a preset speed limit. In the existing speed controllers, the preset vehicle speed limit is either set manually by the administrator/owner of the vehicle or is provided with an inbuilt predefined speed limit at the time of manufacture.

[0003] The speed controllers control the speed of the vehicle by reducing the flow of fuel to the internal combustion engine thereby reducing the overall output torque rate produced from the internal combustion engine. This means the speed controller will keep track of the vehicle's speed through built in speed sensors, and on reaching the preset vehicle speed limit, the speed controller controls the flow of fuel constantly to the internal combustion engine proportionally, so that the internal combustion engine will be unable to burn more fuel to increase or to produce the high output torque. The speed controller takes the input of the vehicle motion speed into account before providing a

constant fuel flow to the internal combustion engine so as to control the vehicle motion.

[0004] The speed limit of the vehicle is generally set based on various factors such as school zones, high traffic zones, overcrowded zones which requires the vehicle speed to be under certain speed limit. But as the speed controller is designed not to cross the speed limit above a certain pre-set speed it is under the wish of the driver to go at a speed he likes in these zones even though he is supposed to go in a preset speed limit. This necessitates the use of a zone based speed controller to limit the speed of the vehicle at the specified zones.

[0005] Another feature in minimizing or regulating the speed of the vehicle is a cruise control option. Cruise control has become an increasingly popular option to be adapted in certain high-priced vehicles in recent years. The cruise control or the automatic speed control option permits the vehicle operator to maintain the vehicle speed at a predetermined speed range while being able to remove his foot from the accelerator pedal. The cruise control option has an obvious advantage in reducing driver fatigue and also providing a marginal increase in fuel economy since a steady speed is maintained and the vehicle is not repeatedly accelerated and decelerated. The major drawback of the cruise control is that the cruise control is primarily adapted inside the Engine Control Unit (ECU) of the engine and the driver has no choice to use the same cruise control other than the one which is provided by the manufacturer in the ECU.

[0006] The conventional vehicle Engine Control Unit (ECU) or built-in ECU offers features like speed limiting and cruise controls as a feature of standard vehicle, however the implementations of these features are different. The vehicle ECU with inherent features like speed limiting and cruise control uses signal interpretation and control logic which is a sub system of engine management logic. The existing ECUs does not include features such as controlled acceleration, speed zone based vehicle speed control, location based speed control, time based speed management etc and thus fail to provide the desired results.

[0007] In view of the foregoing, there is a need to provide a system and method for regulating the vehicle speed at a pre-set speed irrespective of the user control on the accelerator pedal. Further there is a need to provide a system and method for providing cruise control, acceleration control, and related speed regulatory factors in accordance with the driving conditions of the vehicle. Moreover, there also exists a need for a system and method for regulating vehicle speed with a unique anti-tampering mechanism.

[0008] The above mentioned shortcomings, disadvantages and problems are addressed herein, which will be understood by reading the following specification.

C) OBJECTS OF THE INVENTION

[0009] The primary objective of the present invention is to provide a speed regulating system and method for regulating the maximum speed of the vehicle within a preset speed limit irrespective of a user control on the accelerator pedal.

[0010] Another objective of the present invention is to provide a speed regulating system and method which is adapted to dynamically alter the preset maximum speed limit of the vehicle using a control circuit. The control circuit is also known as a main electronic circuit which in co-ordination with one or more external data sources dynamically alters the preset maximum speed limit of the vehicle. This feature of the speed controller is termed as speed governing feature.

[0011] Another objective of the present invention is to provide a speed regulating system and method to stabilize the speed of the vehicle at a pre-set speed limit even if the accelerator pedal is not adequately pressed to reach the pre-set speed limit or excessively pressed to increase the vehicle speed above the pre-set speed limit. This feature of the speed controller is termed as cruise control feature.

[0012] Another objective of the present invention to provide a speed regulating system and method to maintain a minimum variation of the vehicle speed with

respect to the pre-set speed limit when the vehicle is moving in a stabilized speed.

[0013] It is another objective of the present invention to provide a speed regulating system and method adapted to be compatible with all type of vehicles with electronic accelerator pedals irrespective of the operating voltage levels of the Engine Control Unit (ECU).

[0014] It is another objective of the present invention to provide a speed regulating system and method adapted to be compatible with all types of vehicles with electronic accelerator pedals irrespective of the number of accelerator pedal position feedback ports.

[0015] It is another objective of the present invention to provide a speed regulating system and method adapted to be compatible with all type of vehicles using electronic accelerator pedals irrespective of the voltage levels on the pedal position feedback ports.

[0016] It is another objective of the present system to provide a speed regulating system and method to regulate the maximum speed of the vehicle depending on time of the day.

[0017] It is another objective of the present system to provide a speed regulating system and method which provides an acceleration control for the vehicle within a speed range below the maximum preset speed limit.

[0018] It is another objective of the present system to provide a speed regulating system and method which provides audible and visual notifications of errors and other vehicle parameters.

[0019] It is another objective of the present invention to provide a speed regulating system and method with an anti-tamper mechanism to refrain anybody from tampering internal circuitry of the speed regulating system.

[0020] It is another objective of the present invention to provide a speed regulating system and method with a unique sealing mechanism to prevent tampering of the speed regulating system.

[0021] It is another objective of the present invention to provide a speed regulating system and method to enhance fuel efficiency of the vehicle by controlling the acceleration and the maximum speed of the vehicle.

[0022] It is another objective of the present invention to provide a speed regulating system and method which regulates the speed of the vehicle depending on one or more speed regulatory factors like road conditions, traffic density information, terrain information and other geographical factors.

[0023] It is another objective of the present invention to provide a speed regulating system and method to generate additional voltage in case of inadequate voltage output from the accelerator pedal to maintain the speed of the vehicle at the preset speed limit.

[0024] It is another objective of the present invention to provide a speed regulating system and method to operate on a power line voltage configured between a maximum pre-set voltage value and a minimum pre-set voltage value.

[0025] It is another objective of the present invention to provide a speed regulating system and method adapted to operate normally during a power line voltage drop caused due to engine cranking.

[0026] It is another objective of the present invention to provide a speed regulating system and method with a user operable switch to opt for an increase in maximum vehicle speed in accordance with the pre-set speed limit for a predefined time.

[0027] It is another objective of the present invention to provide a speed regulating system and method to disengage the cruise control on receiving indication of at least one of a switch input, brake press or a clutch press.

[0028] It is another objective of the present invention to provide a speed regulating system and method to control the maximum rpm of the engine to limit the vehicle speed within the preset speed limit when vehicle speed information is not received by the system or a tampering is detected.

[0029] It is another objective of the present invention to provide a speed regulating system and method to maintain the vehicle speed at a lower speed limit if a power failure or wire disconnection is detected.

[0030] It is another objective of the present invention to provide a speed regulating system and method to tackle the failure of speed limiting function caused by disconnecting a speed pulse input (tampering).

[0031] It is another objective of the present invention to provide a speed regulating system and method with a display unit to show information regarding the operational status of the vehicle as well as the speed regulating system.

[0032] It is another objective of the present invention to provide a speed regulating system and method which transmits real time information with respect to speed, time, vehicle sensor readings, tampering conditions, operational hour's information and other operational conditions to a data processing and storage unit.

[0033] It is another objective of the present invention to provide a speed regulating system and method to transmit vehicle operational data to a central system.

[0034] It is another objective of the present invention to provide a speed regulating system and method which facilitate full free acceleration of engine rpm when the vehicle is not in motion.

[0035] It is another objective of the present invention to provide a speed regulating system and method to disable the inbuilt cruise control of a vehicle when a voltage regulation is exercised by the speed regulating system.

[0036] It is another objective of the present invention to provide a speed regulating system and method to manually or automatically send alert messages in case of a vehicle break down, accident or tampering of the speed regulating system.

[0037] It is another objective of the present invention to provide a speed regulating system and method which can interact with one or more speed

regulating systems installed in other vehicles for transmitting vehicle operational data to a base station.

[0038] It is another objective of the present invention to provide a speed regulating system and method to record and update vehicle operational parameters to facilitate vehicle tracking.

[0039] It is another objective of the present invention to provide a speed regulating system and method for regulating the maximum engine rpm based on one of engine oil pressure, engine temperature, atmospheric temperature and coolant temperature.

[0040] It is another objective of the present invention to provide a speed regulating system and method to regulate the maximum vehicle speed based on vehicle load condition.

[0041] These and other objectives and advantages of the present invention will become readily apparent from the following detailed description taken in conjunction with the accompanying drawings.

D) SUMMARY OF THE INVENTION

[0042] The various embodiments of the present invention provide a speed regulating system and method. The speed regulating system comprising a memory unit to store a pre-set vehicle speed limit, a speed set means to update the pre-set vehicle speed limit in the memory unit, at least one input means to provide a voltage input to the speed regulating system, a power management unit to regulate power distribution within the speed regulating system, a main electronic circuit adapted to control and co-ordinate a plurality of components of the speed regulating system, a sensor circuitry to detect one or more data signals from the plurality of components and transmit the data signals to the main electronic circuit, a voltage modulation circuit to modulate a voltage from the power management unit based on one or more voltage modulation parameters provided by the main electronic circuit, a voltage adder circuit to generate an output voltage, a voltage regulation circuit to regulate the output voltage provided by the voltage adder circuit based on one or more voltage

regulation parameters from the main electronic circuit and a limping relay to alternate supply of the output voltage to the vehicle Engine Control Unit (ECU). The main electronic circuit regulates the output voltage to the vehicle ECU based on one or more pre-determined speed regulatory factors to control the vehicle speed within the preset vehicle speed limit.

[0043] According to an embodiment of the present invention, the one or more predetermined speed regulatory factors comprises at least one of a terrain parameters, geographical parameters, traffic congestion parameters, zonal parameters, time related parameters, vehicle driving conditions, location-related parameters, weather conditions, vehicle load parameters, vehicle engine temperature parameters and engine fluid parameters. The predetermined speed regulatory factors are transmitted to the speed regulating system through one of an external data sources, communication devices and sensor devices.

[0044] According to an embodiment of the present invention, the output voltage generated by the voltage adder circuit is a summation of the voltage input from the input means and a modulated voltage from the voltage modulation circuit.

[0045] According to an embodiment of the present invention, the speed regulating system further comprises at least one communication unit for transmitting and receiving data from one or more external data sources. The one or more external data sources includes a mobile communication device, a sensor device or any compatible device adapted for capturing vehicle information and the pre-determined speed regulatory factors.

[0046] According to an embodiment of the present invention, the communication unit is a wireless transmission medium or a wired transmission medium.

[0047] According to an embodiment of the present invention, the speed regulating system further comprising at least one at least one real time clock to provide time-related functions, wherein the real time clock is re-set to a random time state when the speed regulating system is tampered or disengaged from the vehicle for a long period of time.

[0048] According to an embodiment of the present invention, the input means is a multi channel accelerator pedal input or an auxiliary input adapted for providing a voltage.

[0049] According to an embodiment of the present invention, the input means is a direct voltage input or a simulation of the direct voltage input.

[0050] According to an embodiment of the present invention, the speed set means to update the preset vehicle speed by at least one of a manual means, data circuits or data sensors.

[0051] According to an embodiment of the present invention, the main electronic circuit is at least one of a digitally programmed micro-controller circuit or a built-in analog circuit adapted to perform functions of the digitally programmed micro-controller circuit.

[0052] According to an embodiment of the present invention, the main electronic circuit includes a speed control algorithm to control the vehicle speed based on the one or more predetermined speed regulatory factors.

[0053] According to an embodiment of the present invention, the speed control algorithm is digitally programmed or hardwired programmed to the main electronic circuit.

[0054] According to an embodiment of the present invention, the sensor circuitry is at least one of a digital sensor circuitry or an analog sensor circuitry.

[0055] According to an embodiment of the present invention, the plurality of sensors transmitting the data signals to the sensor circuitry comprises at least one of a brake press sensor, a clutch press sensor, a speed sensor, a motion sensor, a rain sensor and a visual distance detection sensor.

[0056] According to an embodiment of the present invention, the sensor circuitry is an optically isolated pulse detector circuit connected to the main electronic circuit to detect a pulse count. Here the pulse count detected is proportional to the actual speed of the vehicle.

[0057] According to an embodiment of the present invention, the voltage regulation circuit and voltage modulation circuit is at least one of an analog variable resistance circuit or a digital variable resistance circuit.

[0058] According to an embodiment of the present invention, the voltage modulation circuit provides a regulated voltage output to be added to the input voltage in case of an inadequate voltage input supply for maintaining the speed of the vehicle at the pre-set vehicle speed.

[0059] According to an embodiment of the present invention, the voltage regulation circuit regulates the voltage from the voltage adder circuit based on the input parameters received from the main electronic circuit.

[0060] According to an embodiment of the present invention, the voltage adder circuit is at least one of an analog voltage circuit or a digital voltage circuit which can add voltages from different input sources and give an output voltage equivalent to the added value.

[0061] According to an embodiment of the present invention, the limping relay is at least one of a multi channel analog electro- mechanical circuit or a solid state component to alternate supply of output voltage to the ECU of the vehicle.

[0062] According to an embodiment of the present invention, the main electronic circuit minimizes the vehicle speed during a power failure or a wire disconnection of the speed regulatory system by activating the vehicle ECU error mode. The vehicle ECU error mode is activated by creating a signal failure from the accelerator pedal when the speed regulating system is serially connected to the accelerator pedal.

[0063] According to an embodiment of the present invention, the speed regulating system further comprising a switch input means to enhance the maximum vehicle speed for a short period of time, a box open identification switch to detect tampering, a battery to operate independently in powering the box open identification switch and the power management unit, a rechargeable power unit to charge the battery and a cruise control disengage circuit to deactivate a cruise control of the vehicle during pre-defined conditions.

[0064] According to an embodiment of the present invention, the switch input means signals the main electronic circuit to compute a permissible pre-set vehicle speed limit.

[0065] According to an embodiment of the present invention, the box open identification switch is activated by opening a casing of the speed regulatory system.

[0066] According to an embodiment of the present invention, the box open identification switch on activation re-sets the real time clock to the random time state.

[0067] According to an embodiment of the present invention, the main electronic circuit deactivates the cruise control on receiving a switch input or switch input indicative of a brake press or a clutch press.

[0068] According to an embodiment of the present invention, the limping relay is adapted to switch off the voltage supply to the vehicle ECU managed by the main electronic circuit depending on various inputs as well as on failure of a power supply to the speed management system.

[0069] According to an embodiment of the present invention, the main electronic circuit on processing an error code indicative of the tampering instructs the voltage regulation circuit to minimize the output voltage to regulate the engine rpm so as to maintain the vehicle speed lower than the pre-set maximum speed.

[0070] According to an embodiment of the present invention, the speed regulatory system is arranged between an input and the vehicle ECU to regulate the voltage from the input means to the vehicle ECU to provide for at least one of a speed limiting, cruise control, terrain based speed control, geographical location based speed control, traffic congestion based speed control, zonal parameters based speed control, time-related based speed control, vehicle driving conditions based speed control, weather conditions based speed control, vehicle load parameters based speed control, vehicle engine temperature parameters based speed control and engine fluid parameters based speed control of the vehicle.

[0071] According to an embodiment of the present invention, the speed regulating system further comprising an output means to provide one of an audible output and a visual output indicative of the vehicle parameters or speed management unit parameters detected by the main electronic circuit.

[0072] According to an embodiment of the present invention, the audible output means includes a buzzer or a speaker and visual output includes one or more display units.

[0073] According to an embodiment of the present invention, the voltage generated during a fully pressed state, a partially pressed state and a non-pressed state of the accelerator pedal is recorded to prevent the output voltage from going below or more than a working voltage level and the desired parameters.

[0074] According to an embodiment of the present invention, the speed of the vehicle is controlled upon exceeding the preset vehicle speed limit by varying a throttle position voltage of the vehicle.

[0075] According to an embodiment of the present invention, the speed regulating system generates a brake switch signal and transmits the brake switch signal to the vehicle ECU to deactivate any cruise control fitted to the vehicle when the vehicle speed exceeds the pre-set speed limit.

[0076] According to an embodiment of the present invention, the speed regulating system is adapted to interact with one or more speed regulating systems installed in nearby vehicles to transmit alerts during a vehicle fault.

[0077] Embodiments of the present invention further provide a method of regulating a vehicle speed within a pre-set speed limit. The method comprising steps of defining a pre-set vehicle speed limit, updating the pre-set vehicle speed limit, detecting an actual vehicle speed, comparing the actual vehicle speed with the updated pre-set vehicle speed limit, determining if the updated pre-set vehicle speed limit is greater than the actual vehicle speed, activating a voltage adder circuit and voltage modulation circuit for increasing an voltage input to a voltage regulation circuit in conjunction with an accelerator pedal input voltage, activating the voltage regulation circuit for increasing or

reducing the voltage input from the voltage adder circuit to simulate a vehicle accelerator pedal and monitoring the speed of the vehicle periodically and updating the pre-set speed limit through a main electronic circuit for speed regulation actions. The main electronic circuit processes signals corresponding to the vehicle speed and the pre-set speed limit to automatically regulate the actual vehicle speed based on a set of pre-determined speed regulatory factors.

[0078] According to an embodiment of the present invention, the one or more predetermined speed regulatory factors comprise at least one of a terrain parameters, geographical parameters, traffic congestion parameter, zonal parameters, time-related parameters, vehicle driving conditions, location-related parameters, weather conditions, vehicle load parameters, vehicle engine temperature parameters and engine fluid parameter. The predetermined factors are transmitted to the speed regulating system through one of an external data sources, communication devices and sensor devices.

[0079] According to an embodiment of the present invention, the method of regulating a vehicle speed further comprising detecting tampering of the speed regulatory system on identifying an opening of a casing or disengaging of the speed regulating system from the vehicle, wherein the tampering results in at least one of re-setting of a real-time clock to a random time state, transmitting a tampering alert to the main electronic circuit, transmitting a tampering related information through at least one of a communication unit to a central system, recording the tampering related information in a memory unit and transmitting an error code the main electronic circuit which in turn reduces the voltage supply to the limping relay such that the vehicle operates in a limp mode.

[0080] According to an embodiment of the present invention, the limp mode is defined as a vehicle operational condition where the pre-set vehicle speed is dynamically set to a minimum speed limit to maintain the vehicle engine in an active state.

[0081] According to an embodiment of the present invention, the power management in the speed regulation system is controlled by a power

management unit wherein the power management unit is powered by a external voltage sources such as a vehicle battery or a built-in rechargeable battery.

[0082] According to an embodiment of the present invention, the speed regulation system comprises a recharge circuit connected serially between the power management unit and the in-built battery wherein the recharge circuit provides power to recharge the built-in battery.

[0083] According to an embodiment of the present invention, the power management unit is powered by the built-in battery in case of a failure in the external power source powering up the power management unit.

[0084]

[0085] These and other aspects of the embodiments herein will be better appreciated and understood when considered in conjunction with the following description and the accompanying drawings. It should be understood, however, that the following descriptions, while indicating preferred embodiments and numerous specific details thereof, are given by way of illustration and not of limitation. Many changes and modifications may be made within the scope of the embodiments herein without departing from the spirit thereof, and the embodiments herein include all such modifications.

E) BRIEF DESCRIPTION OF THE DRAWINGS

[0086] The other objectives, features and advantages will occur to those skilled in the art from the following description of the preferred embodiment and the accompanying drawings in which:

[0087] **FIG. 1** illustrates a prior-art representation in which an input means provide a voltage to the engine control unit (ECU) to control the vehicle speed.

[0088] **FIG. 2** is a block diagram illustrating a speed regulatory system installed in a vehicle in conjunction with the vehicle ECU and a voltage input means, according to an embodiment of the present invention.

[0089] FIG. 3 is a system diagram illustrating the components of the speed regulating system to regulate the vehicle speed within a pre-set speed limit according to an embodiment of the present invention.

[0090] FIG. 4 illustrates the components of a speed regulatory system for providing a speed limiting, acceleration control and time based speed management features in a vehicle according to an embodiment of the present invention.

[0091] FIG. 5 illustrates the components of a speed regulatory system for providing the cruise control feature in a vehicle according to an embodiment of the present invention.

[0092] FIG. 6 is a block diagram illustrating the components of a speed regulatory system for providing an anti-tampering feature in a vehicle according to an embodiment of the present invention.

[0093] FIG. 7 is a flow diagram illustrating a method of regulating vehicle speed within a pre-set speed limit according to an embodiment of the present invention.

[0094] FIG. 8A is graph chart illustrating a vehicle speed management and performance during a normal operational mode of the vehicle according to an embodiment of the present invention.

[0095] FIG. 8B is graph chart illustrating a vehicle speed management and performance during a limp mode operation of the vehicle according to an embodiment of the present invention.

[0096] Although specific features of the present invention are shown in some drawings and not in others. This is done for convenience only as each feature may be combined with any or all of the other features in accordance with the present invention.

F) DETAILED DESCRIPTION OF THE INVENTION

[0097] In the following detailed description, reference is made to the accompanying drawings that form a part hereof, and in which the specific embodiments that may be practiced is shown by way of illustration. These

embodiments are described in sufficient detail to enable those skilled in the art to practice the embodiments and it is to be understood that the logical, mechanical and other changes may be made without departing from the scope of the embodiments. The following detailed description is therefore not to be taken in a limiting sense.

[0098] The various embodiments of the present invention provide a system and method for regulating the vehicle speed within a pre-set speed limit. The system comprising of a memory unit to store a pre-set vehicle speed limit, a speed set means to update the pre-set vehicle speed limit in the memory unit, at least one input means to provide a voltage input to the speed regulating system, a power management circuit to regulate power distribution within the speed regulating system, a main electronic circuit adapted to control and co-ordinate a plurality of components of the speed regulating system, a sensor circuitry to detect one or more data signals from the plurality of components and transmit the data signals to the main electronic circuit, a voltage modulation circuit to modulate a voltage from the power management circuit based on one or more voltage modulation parameters provided by the main electronic circuit, a voltage adder circuit to provide additional modulated input voltage, a voltage regulation circuit to regulate an output voltage provided by the voltage adder circuit based on one or more voltage regulation parameters from the main electronic circuit and a limping relay to provide alternate supply of the output voltage to the vehicle Engine Control Unit (ECU) wherein the main electronic circuit regulates the output voltage to the vehicle ECU based on one or more pre-determined speed regulatory factors to control the vehicle speed within the preset speed limit.

[0099] The one or more speed regulatory factors which the main electronic circuit takes into consideration for regulating the speed of the vehicle comprises at least one of a terrain conditions, geographical parameters, traffic congestion parameters, zonal parameters, time parameters, driving conditions, location parameters and weather conditions and the like. The predetermined factors are transmitted to the speed regulating system through one of an

external data sources, sensor devices and communication devices such as Global Positioning Systems (GPS), location identifiers etc. The external data sources include pre-programmed or dynamically updated data from mobile towers, data transmitted through a mobile wireless network or a radio network. The sensor device which provides the required data or parameters to regulate the speed of the vehicle includes a micro data trans-receiver installed at required geographical locations to transmit data or speed control parameters to the speed regulating systems. The micro trans-receiver devices also record various parameters relating to a vehicle that has move passed the micro data trans-receiver device installed in a particular location. The control or data parameters in the micro data trans-receiver devices are updated through manual process by connecting it to a general data processing and storage machine or through any of a standard wireless transmission medium.

[00100] The main electronic circuit of the speed regulating system employs a voltage regulation circuit and a voltage modulation circuit which is generally an analog or a digital voltage potentiometer to control the excessive voltage of the accelerator pedal from reaching the vehicle Engine Control Unit (ECU). The voltage modulation circuit generates the required voltage in case an inadequate voltage output is detected from the accelerator pedal to maintain the speed of the vehicle at the preset speed limit. The voltage regulation circuit is used to control the flow of voltage from a voltage adder circuit to the limping relay based upon one or more pre-determined speed regulatory factors.

[00101] The voltage adder circuit takes one voltage input from the input means such as accelerator pedal or values from throttle position sensor and the other voltage input from the voltage modulation circuit to provide a summed additional constant input voltage to a voltage regulation circuit. The voltage regulation circuit obtains two inputs (i.e.) one input from the voltage adder circuit and the other input from the main electronic circuit. The input received from the voltage adder circuit comprises of a voltage power to be provided to the vehicle ECU to increase or decrease the acceleration speed of the vehicle. The other input received from the main electronic circuit to the voltage

regulation circuit comprises of various data parameters. These data parameters are calculated in the main electronic circuit by a pre-programmed speed control algorithm and data obtained from various internal and external sensors including the external data sources and the central data servers.

[00102] The main electronic circuit on determining the required voltage to be allowed from the voltage regulation circuit to the vehicle ECU, transmits a signal to the voltage regulation circuit from the main electronic circuit comprising voltage regulation parameters. Based on the parameters received from the main electronic circuit, the voltage regulation circuit regulates the flow of voltage from the speed regulation system to the vehicle ECU thereby reducing the vehicle speed.

[00103] The speed control parameters such as zone based speed control, traffic density based speed control, cruise control, time based speed control, terrain based speed control and the likely parameters are programmed to the speed control algorithm in the main electronic circuit. Further the speed control algorithm in co-ordination with various sensor input components, data input components and external data input components such as obtaining a terrain or weather information through GPS satellite information, processing the received parameters in the main electronic circuit and outputting the required parameter to the voltage regulation circuit. The voltage regulation circuit on receiving the input parameters from the main electronic circuit controls the flow of voltage from the voltage adder circuit to the limping relay. The limping relay is an electro-mechanical relay which comprises of at least two states. In the first state, the limping relay allows a flow of voltage to the vehicle ECU from the voltage regulation circuit without any resistance. In the second state, the limping relay disconnects the input means from the vehicle ECU thereby no voltage is provided to the vehicle ECU by the speed regulating system.

[00104] The limping relay will normally work in the first state by providing regulated output voltage to the engine ECU thereby regulating the speed of the vehicle. But during exceptional circumstances such as detection of any tampering or a tampering error code in the speed regulation system, the limping

relay switches to second state where there is a voltage cut-off to the vehicle ECU. The voltage cut-off to the vehicle ECU is achieved by providing a very low voltage as compared with the operational voltage of the limping relay thus simulating the disconnection of the input means with the vehicle ECU.

[00105] During the second state of the limping relay, the limping relay disconnects the input means to the vehicle ECU to restrict the voltage input being transmitted to the vehicle ECU to control the speed of the vehicle. When the vehicle ECU detects that the input voltage which is generally through the accelerator pedal is disconnected or disengaged from the vehicle ECU, the vehicle ECU will start operating in the error mode and enters to the limp mode. During the limp mode the vehicle operates in a very limited speed so that the user at any driving condition is unable to increase the speed of the vehicle beyond a limp mode pre-set speed limit.

[00106] The speed regulating system further comprises an anti-tampering unit to prevent tampering. The anti-tampering unit comprises a casing connected to the vehicle engine and the main electronic circuit of the vehicle, a switch provided on the casing and a battery powered clock. An opening of the casing activates the switch which triggers the clock to a reset which in turn triggers the main electronic circuit unit to go to a permanent error mode.

[00107] On detection of a tampering to the speed regulation system or generation of a tampering error code, the limping relay will stop the free flow of voltage through it and disconnects the voltage output to the vehicle ECU. The disconnection of the voltage lines to the vehicle ECU activates the built in vehicle ECU error code thereby enabling the vehicle to move at very low speed.

[00108] The speed control program/ algorithm is digitally programmed to the main electronic circuit if the main electronic circuit is a digitally programmable microcontroller and hard-wired programmed if the main electronic circuit is a analog circuit built to perform the similar operations of the digital microcontroller circuit.

[00109] The speed of the vehicle is changed based on at least one of the time that includes the increase and decrease of the supply voltage to the engine of the vehicle depending on the clock time of the day of drive, vibrations induced on the vehicle upon its movement on the terrain surface and cruise control includes the disengagement upon the application of frequent brakes and the vehicle reaching the preset speed.

[00110] The system according to the present invention is adapted to be connected to the vehicle's electric system and equipped with operator input controls, adapted to exercise control over the pedal position signal from the accelerator pedal or to generate accelerator position equivalent signals to simulate pressing of accelerator pedal. The system is designed to be used in vehicles that use Electronic Accelerator Pedals (broadly known as Throttle position sensor (TPS) based accelerator pedals) that generates a voltage output which is directly proportional to the position of the accelerator pedal. The speed regulating system is connected serially between the accelerator pedal and the vehicle ECU with the objective of conditioning the voltage from the accelerator pedal by either reducing or increasing the voltage, thus to achieve the functions of cruise control, maximum speed control, acceleration control and time based speed control. The speed regulating system is also provided with an anti-tampering detection and prevention feature to prevent unnecessary tampering. The anti-tampering feature prevents tampering of the system by opening the cover or by cutting the sensor inputs. The system also incorporates vehicle cruise disabling system to deactivate cruise control built in to the vehicle ECU when controls are exercised by this system as such cruise controls can overcome the control efforts to limit the speed or acceleration. The cruise control feature of the vehicle is deactivated by sending a brake signal applied to the vehicle ECU on a continuous pattern to ensure that the built in cruise control feature is kept deactivated continuously throughout the time the control is exercised by the speed regulating system.

[00111] The speed regulating system measures speed information in the form of pulses provided from the vehicle. The pulses are taken from built in speed

sensors or from additional speed sensors. The speed regulating system works on the vehicle battery and takes very less current which is less than 150 milliamps. The circuit identifies the speed of the vehicle from the count of pulse (square or sine type) that is directly proportional to the speed of the vehicle. The speed in relation to the time gives the acceleration of the vehicle. The speed and acceleration is computed many times in a second for effective control.

[00112] The accelerator pedal or the Throttle Position Sensor (TPS) generates one or more channels of parallel moving voltages depending on the position of the accelerator pedal. This voltage is used by the vehicle ECU to identify the demand of the driver to increase or decrease the vehicle's speed and also the level of acceleration or deceleration demanded by the driver. The speed regulating system can manage two or more simultaneous outputs from the accelerator pedal which generate a voltage relative to the pedal position. The speed regulating system only controls the accelerator pedal output and uses the acceleration and deceleration capability of the engine's power to achieve the desired speed control.

[00113] The speed regulating system is also equipped with a cruise control feature which requires conditioning of voltage signal from accelerator pedal to maintain the speed for the vehicle within a set speed range irrespective of the accelerator pedal position. This requires the speed regulating system to induce voltage into the line as well as reduce the voltage depending on various driving and terrain conditions.

[00114] When the speed regulating system is in speed limiting mode, it modifies the voltage from the accelerator pedal by reducing the voltage as required. The speed limiting feature ensures that a driver cannot drive the vehicle more than the set speed. This means that while the system is in speed limiting mode, no external voltage is induced into the line, but only reduced as required. This assures that the maximum speed of the vehicle will never be more than the user input. However if the accelerator pedal output voltage is more than the speed required to limit the speed at maximum speed, the system

reduces the voltage from the accelerator pedal to maintain the vehicle at the permitted maximum speed limit. The speed limiting feature is a hardware capability controlled by software. The control on maximum speed not only gives more control over the driving but also reduces the impact of any accidents thus ensuring lesser accidents and more importantly less devastation of life and property in case of an accident. The speed limiting can be done without following any standards as a performance guide; however the speed regulating system according to the embodiments herein is built to meet the performance guidelines as in International Standards like AIS 018 for Speed Limiters.

[00115] The acceleration control is a user configurable parameter of Speed regulatory system where the user provides the speed range for the speed regulating system to manage the maximum acceleration of the vehicle. This speed range is considered as a low risk speed zone. The low risk speed zone is a speed range below the maximum permitted set speed and the high risk speed is the speed in excess of maximum permitted set speed. It is assumed that the maximum permitted set speed for each vehicle will be depended on the performance capabilities of the vehicle. The control on maximum acceleration, especially at high speeds, not only gives more control over the driving but also makes driving very smooth as well as prevents rash driving. Acceleration Control feature is a software capability of the speed regulating system and it uses the hardware available for speed limiting as well as cruise control to perform the acceleration control.

[00116] The system further includes a unique feature called as the Time based Speed Management to reduce the maximum speed of the vehicle depending on time of the day. Depending on geographical conditions at various places around the world, the parameters can be set and a much safer driving habit can be enforced. An example of such a situation is to reduce the speed of the vehicle to about 75% of the maximum permitted speed after mid night till early morning where there is a high probability of driver getting sleepiness. The visibility is also much low during this time of the day. This reduction of speed

not only gives more control over the driving but also reduces the impact of any accidents thus ensuring lesser accidents and more importantly less devastation of life and property in case of an accident. Time based speed management is a software capability of the speed regulating system and it uses the hardware available for speed limiting to perform the acceleration control.

[00117] The speed regulating system is also provided with anti tampering features to identify such tampering and to de-motivate people from doing it. Tampering is normally done by disconnecting the speed input line, disconnecting the power line and doing any modification to the electronic circuits therein. When the speed input line or power line is disconnected, the speed regulating system goes to a limp mode which will restrict the power of the vehicle to a very low level. Another form of tampering is the opening of the speed regulating system and doing tampering of the circuit. The speed regulating circuit includes a built in battery managed circuitry which will identify that the casing is opened even if the power to the speed regulating system is disconnected. On detecting that the casing is opened, the software goes to a permanent lock down which can be only reset by using authorized persons and tools. Another form of tampering is removing the speed regulating system and directly connecting the input and the output. To restrict such form of tampering, the inputs and outputs are within a tamper proof sealed casing. Anti tampering feature use a hardware as well as software capability to achieve the result.

[00118] The speed regulating system further includes another anti-tampering feature referred as vehicle cruise disabling system. The brake switch and clutch switch are electrical switches which sends signal to the vehicle ECU. Cruise control function built into the vehicle's ECU gets disengaged when a brake switch signal or clutch switch signal is detected. The speed regulating system simulates the brake switch signal when a restrictive action is in operation, thus deactivating the vehicle cruise control if in case it is activated by the driver. The speed regulating system also send this signal in an intermittent fashion during the control implemented time to ensure that driver does not have the

capability to use the cruise control to over ride the speed regulating system control. The vehicle cruise disabling system uses hardware as well as software capability to achieve the result.

[00119] The system generates a brake switch signal and transmits the brake switch signal to the ECU to deactivate the cruise control when the vehicle speed exceeds the pre-set speed.

[00120] The speed regulatory system further includes an output means to deliver audible and visual outputs of various vehicle speed conditions and parameters along with the condition of the speed regulation system analyzed by the main electronic circuit. The output means include at least one of a audio speaker or a buzzer for providing an audio output and visual display or LED lights for providing visual output in case of any fault conditions, speed violation and alert service.

[00121] The system further comprises a powering means including at least one of a vehicle battery and an auxiliary rechargeable battery power connected to a recharge circuit. The auxiliary rechargeable battery uses the recharge circuit to charge the rechargeable battery connected to the power management unit. During a power input failure to the power management unit, the power management unit is powered by the auxiliary battery power source which is a limited power source. The time based speed sensor is powered by at least one of the vehicle power and the auxiliary rechargeable internal battery power source. The sensor for detecting pulse from speed sensor of a vehicle is an optically isolated pulse connected to the main electronic circuit.

[00122] The speed regulatory system arranged between the accelerator pedal and the ECU of the vehicle regulates the voltage from the accelerator pedal so as to provide for cruise control, speed control, acceleration control and time based speed control.

[00123] The voltage from the accelerator pedal at slow speed is recorded for protecting the control system to prevent voltage from going less than the minimum required level of the vehicle.

[00124] The speed of the vehicle is controlled upon exceeding the preset speed by controlling the throttle position voltage of the vehicle by varying the voltage.

[00125] The acceleration control is adapted to control the vehicle speed from a lower speed of the speed control limit to a permitted maximum speed.

[00126] FIG.1 illustrates a prior-art representation in which an input means provide a voltage to the engine control unit (ECU) to control the vehicle speed. As shown in FIG. 1, the user provides input to the Engine control unit (ECU) 102 through the input means 101 which is at least an electronic accelerator pedal or an electronic or mechanical device adapted to perform the similar functions of the electronic accelerator pedal. The Engine control unit (ECU) 102 comprises of internal circuits and algorithms which govern the speed and motion of the vehicles by providing control signals such as acceleration signals and de-acceleration signals to the engine 103. As the features provided by the Engine control unit (ECU) 102 are in-built during the manufacturing with limited exercise controls, the user cannot adapt any new features by himself. The Engine control unit (ECU) can be configured to implement additional features or customizing the built in features for providing speed regulation in the vehicles.

[00127] FIG.2 is a block diagram illustrating a speed regulatory system installed in a vehicle in conjunction with the vehicle ECU and a voltage input means, according to an embodiment of the present invention. The speed regulation system 201 is serially connected between the input means 101 and the Engine Control Unit (ECU) 102 to regulate the voltage signal from the input means 101 to the Engine Control Unit 102. The speed regulation system 201 provides a conditioned and regulated voltage to the Engine Control Unit (ECU) 102 based upon one or more speed regulatory factors such as road traffic density, speed zones, geographical terrain, time of the day etc computed by a built-in speed control algorithm. The speed regulation system 201 is powered by an externally placed power input 202 such as a vehicle battery.

[00128] FIG.3 is a system diagram illustrating the components of the speed regulating system to regulate the vehicle speed within a pre-set speed limit according to an embodiment of the present invention. The speed regulating system 201 comprises a voltage adder circuit 301 to provide an additional modulated input voltage, a voltage regulation circuit 302 to regulate an output voltage provided by the voltage adder circuit based on one or more voltage regulation parameters, a main electronic circuit 303 adapted to control and co-ordinate a plurality of components of the speed regulating system, a voltage modulation circuit 304 to modulate a voltage from the power management circuit 316 based on one or more voltage modulation parameters provided by the main electronic circuit 303, a limping relay 305 to provide alternate supply of the output voltage to the vehicle Engine Control Unit (ECU) 102, a cruise control disengage circuit 306 to deactivate a cruise control of the vehicle, a motion sensor 307 to detect the vehicle motion, a memory 308 to store and update a pre-set speed data, a speed sensor 309 to determine the speed of the vehicle, a switch input 310 to enhance the maximum vehicle speed for a short period of time, a communication circuit 311 to communicate wired and wireless devices, a sensor circuit 312 to read and transmit the sensor readings, a box open identification switch 313 to detect tampering, a real time clock 314 to provide functions relating to the time of the day, a battery 315 to operate independently in powering the box open identification switch and the power management unit, a power management unit 316 for powering the speed regulation system 201 and a charging circuit 317 to charge the battery.

[00129] The voltage adder circuit 301 takes one voltage input from the input means 101 such as accelerator pedal or values from throttle position sensor and the other voltage input from the voltage modulation circuit 304 to provide a summed additional constant input voltage to a voltage regulation circuit 302. The voltage regulation circuit 302 obtains two inputs (i.e.) one input from the voltage adder circuit 301 and the other input from the main electronic circuit 303. The input voltage received from the voltage adder circuit 301 comprises of a voltage power to be provided to the vehicle Engine Control Unit 102 to

increase or decrease the acceleration speed of the vehicle. The other input received from the main electronic circuit 303 to the voltage regulation circuit 302 comprises of various data parameters. These data parameters are calculated in the main electronic circuit 303 by a pre-programmed speed control algorithm and data obtained from various internal and external sensors through sensor circuits 312, data from external data sources and the central data servers through communication unit 311, the speed sensor 309 and motion sensor 307.

[00130] Further the speed control algorithm in the main electronic circuit 303 in co-ordination with various sensor circuits 312, communication unit 311, speed sensor 309, motion sensor 307 obtains data pertaining to a terrain or weather information through GPS satellite information, processes the received parameters in the main electronic circuit 303 and outputs the required parameter to the voltage regulation circuit 302. The voltage regulation circuit 302 on receiving the input parameters from the main electronic circuit 303 controls the flow of voltage from the voltage adder 301 circuit to the limping relay 305. The limping relay 305 is an electro-mechanical relay which comprises of at least two states. In the first state, the limping relay 305 allows full flow of current to the Engine Control Unit (ECU) 102 from the voltage regulation circuit 201 without any resistance and in the second state the limping relay 305 disconnects the input means 101 from the vehicle Engine Control Unit (ECU) 102 thereby no voltage is provided to the Engine Control Unit (ECU) 102 by the speed regulating system 201. The Engine Control Unit (ECU) 102 on detection of no voltage from the input means 101 enters into a error state there by maintaining the speed of the vehicle very low.

[00131] A switch input 310 connected to the main electronic circuit 303 has a unique feature. At certain conditions when the driver of the vehicle requires an extra or full acceleration power above the pre-set speed limit to activate the switch input 310. The switch input 310 commands the main electronic circuit 303 and the speed control algorithm which is pre-programmed inside the main electronic circuit 303 to provide full acceleration access to the driver of the vehicle for a pre-set period of time.

[00132] The speed regulation system 201 is powered by an external power input 202. The external power input 202 is a vehicle battery and provides power to the speed regulation system 201 through a power management unit 316. The power management unit 316 is adapted to work with varying power input and power output levels thereby providing a constant required voltage to the speed regulation system 201. The power management unit 316 has a battery input 315 and provides power output to recharge unit 317 and main electronic circuit 303. The recharge unit 317 provides power to charge the battery 315. Hence under certain circumstances where the power input 202 fails powering power management unit 316, the battery 315 will provide a backup power for a limited period of time to the power management unit 316.

[00133] The speed regulation system 201 has a unique anti tampering feature incorporated into it. As the speed regulation circuit 201 is connected serially between the input means 101 and the engine control unit 102 tampering can happen if the user tries to disengage or disconnect the speed regulation system 201 or open the casing of the speed regulation system 201 to tamper the circuits. As the box open identification switch 313 is powered independently by the battery 315, the box open identification switch 313 detects the tampering and resets the real time clock 314 with a random time state. The real time clock 314 on a date reset 314 is detected by the box open identification switch 313 which in turn alerts the main electronic circuit 303 to cut off the voltage passing to the Engine control unit (ECU) 102 from the input means 101, thereby enabling the vehicle to be active in the limp mode.

[00134] The speed regulation system also comprises a cruise control disengage circuit 306. When the speed regulation system 201 determines to limit the speed of the vehicle below the pre-set speed limit, it sends cruise control disengage signals from the main electronic circuit 303 to the cruise control disengage circuit 306. The cruise control disengage circuit 306 deactivates the cruise control feature of the vehicle by sending a brake signal applied to the vehicle engine control unit (ECU) 102 on a continuous pattern to ensure that

the built in cruise control feature is kept deactivated continuously throughout the time the control is exercised by the speed regulating system 201.

[00135] FIG. 4 illustrates the components of a speed regulatory system for providing a speed limiting, acceleration control and time based speed management features in a vehicle according to an embodiment of the present invention. The speed set means provided in the speed regulation system 201 sets a maximum speed for driving a vehicle and the speed regulation system 201 controls the output from the input means 101 such as accelerator pedals by restricting the vehicle driving speed from exceeding the pre-set speed range. The speed regulation system 201 maintains the vehicle speed within the permitted speed range by reducing voltage output from the input means 101 such as accelerator pedal to simulate that input means 101 is released adequately as required. The power from the input means 101 is a direct current and its voltage ranges from zero to a maximum (depending on the input means being used i.e. electronic accelerator pedal model, voltage rating etc) depending on the input means 101 position. As the power goes through the dual port controllable circuitry for the control the voltage drops a little due to the resistance offered by the circuit. To compensate for the voltage drop, the voltage adder circuit 301 provides an external voltage which is induced along with the voltage from the input means 101. The control of the voltage as well as the inducing of voltage is done using the voltage modulation circuit 304 controlled by the main electronic circuit 303. The induced voltage is then sent through the voltage adder circuit 301 to mix up with the voltage from the input means 101. The speed regulating system 201 reads the voltage from the input means 101 as well as the speed of the vehicle through speed sensor 309 and sensor circuit 312 and reduces the voltage if the speed is above the preset speed range and provides full input as output voltage which is less than the permitted level. Whenever the speed is above or just near the maximum permitted speed, the speed regulating system 201 generates a signal like the brake switch signal and sends it to the vehicle Engine control Unit (ECU) 102 to deactivate any cruise control if applied. The output means such as buzzer, speaker, visual

display and LED lights are used to provide visual confirmation and audible confirmation of any errors or other conditions like over speed and the like.

[00136] The speed regulating system 201 controls the maximum acceleration of the vehicle within the controlled speed zone. The acceleration control is exercised using a speed limiting algorithm. The acceleration control slowly enhances the maximum speed permitted in order to slowly allow the vehicle to move from the lower speed of acceleration control to the permitted maximum speed. For example, if the maximum speed is 120Km/hr, a safety speed zone is created below the 120 speed mark, for instance 80 Km/hr. The acceleration of the vehicle will be configured between 80 and 120 so as to provide a safety driving condition. In the above case when the speed of the vehicle reaches 80 km/hr, the maximum speed permitted becomes 80 and moves to 120 gradually. This means that 80 become 80.1 and then 80.2 and so on until the speed reaches the maximum permitted speed of 120. The time between the speed changes will change the time required for the vehicle to reach the top speed. The change in speed with respect to time is acceleration and hence the acceleration control is achieved.

[00137] The speed regulating system further comprises a real time clock 314 which works on the vehicle's power source as well as the rechargeable battery 315. The real time clock 314 used herein is a high energy efficient clock which is adapted to work with even the auxiliary power source as the powering means may not be available and might need to resetting of time stored in the clock. A standby rechargeable battery 315 is also provided as alternative power source for the real time clock 314 to ensure that it runs for a very long time even if the vehicle's power is disconnected. The time based speed management is mostly helpful during night time when driver response becomes slow due to various factors like reduced visibility, sleepiness etc. The maximum speed of the vehicle will then be reduced as configured. One typical configuration is to bring down the maximum vehicle speed by 10% by night 10Pm and then again by 25% by night 12 Pm and increase 25% back by 5am and rest 10% by 6 am to give full limit during the day time.

[00138] In one embodiment, the speed regulating system 201 further comprises a vehicle load based and vehicle fluid temperature based speed control to enhance the efficiency of the vehicle by provide more mileage. When the speed regulation 201 is powered up the speed control algorithm inside the main electronic circuit 303 computes the vehicle load. Vehicle load can either be passengers in the vehicle or a commodity. The vehicle load is determined by various sensor through the sensor circuit 312 and the corresponding data value is passed to the main electronic circuit 303 for computation. The main electronic circuit 303 on computing the load provides speed control parameter to the voltage regulation circuit thereby limiting the speed of the vehicle. As an example, if the permissible load for a vehicle installed with a speed regulating system 201 is 5 passenger and the speed regulation system 201 detects that there are 7 passengers in the vehicle, the speed regulation system 201 then instructs the voltage regulation circuit 302 through the main electronic circuit 303 to reduce the maximum permissible speed by 25% to ensure efficiency of the fuel burnt, to provide a better mileage and under certain safety norms.

[00139] In case of vehicle fluid temperature based speed control, the main electronic circuit 303 monitors various fluids of the vehicle such as engine coolant fluid, engine oil fluid, lubricating fluids etc through sensor circuit 312. The speed control algorithm inside the main electronic circuit 303 computes the heat values received from the sensor regarding engine oil, engine coolant etc and compares with the pre-define heat values permissible for the particular vehicle which has the speed regulation system installed. If the heat values or the temperature values of the vehicle is high or above the pre-defined heat values, the main electronic circuit 303 sends voltage control parameters to the voltage regulation circuit 302 to reduce the flow of voltage from the voltage adder circuit 301 to engine control unit 102 thereby reducing the speed of the engine RPM. The reduction of the engine RPM has various significant advantage which include more efficient fuel usage, more mileage per gallon of fuel etc.

[00140] FIG. 5 illustrates the components of a speed regulatory system for providing the cruise control feature in a vehicle according to an embodiment of the present invention. The cruise control feature of the speed regulating system 201 is provided for conditioning of the voltage signal from input means 101 and to maintain the pre-set speed limit of the vehicle even when the accelerator pedal which is a input means 101 is pressed continuously. The speed regulating system induces voltage into the output line of the input means 101 as well as reduces the voltage depending on various driving and terrain conditions. The voltage inducing is done through a voltage modulation circuit 304. The output of the voltage modulation circuit 304 is passed through the voltage adder circuit 301. The voltage adder circuit 301 takes one input from the input means 101 and the second input from the voltage modulation circuit 304. The output of the voltage adder circuit 301 which is a summation of the voltages received from the input means 101 and the voltage modulation circuit 304 is provided as the input to the voltage regulation circuit 302. The voltage regulation circuit 302 maintains the speed of the vehicle by controlling the input voltage to the engine control unit 102 based upon various parameters computed by the main electronic circuit 303 and thus providing the cruising speed for the vehicle. The input to the voltage regulation circuit 302 will be equivalent to the voltage generated when the accelerator pedal or the input means 101 in full pressed condition as the voltage adder circuit 301 provides a full voltage range. To protect the vehicle engine control unit 102 from excessive voltage from the voltage adder circuit 301, the voltage regulation circuit also 302 also provides the function of a protection circuit to restrict the maximum voltage passing from the voltage adder circuit 301 to the engine control unit 102.

[00141] FIG. 6 is a block diagram illustrating the components of a speed regulatory system for providing an anti-tampering feature in a vehicle according to an embodiment of the present invention. Tampering is normally done by disconnecting the input means 101, disconnecting the power input 202 lines and any modification to the electronic circuits of the speed regulating system 201. If the speed regulating system 201 is tampered, the speed

regulating system 201 does not generate a speed pulse which is identified by the main electronic circuit 303. The absence of the speed pulse input to the engine control unit 102 simulates the condition where the input means 101 is disconnected from the engine control unit 102. The engine control unit 102 on sensing that there is no speed pulse input or voltage input, switches to error mode thereby allowing the vehicle to run in a limp state. The main electronic circuit 303 hence cuts off the input voltage to the engine control unit 102 allowing the engine to operate in limp mode where the maximum speed of the vehicle will be very less. The main electronic circuit 303 also identifies whether the system is working on the auxiliary power from the input means 101 also known as accelerator pedal or from the main power input 202 source. If the system is running on the power source from the input means 101 i.e. accelerator pedal voltage, the maximum speed limit is reduced.

[00142] Further if the main electronic circuit 303 identifies the opening of the case enclosing of the speed regulation system components a box open identification switch 313 is activated which triggers the real time clock 314 date to be reset and this reset in turn triggers the main electronic circuit 303 to go to a permanent error mode which can be only re activated by using special tools and authorized users.

[00143] FIG. 7 is a flow diagram illustrating a method of regulating vehicle speed within a pre-set speed limit according to an embodiment of the present invention. At step 701, the speed regulation system and the engine control unit is powered ON at step 702, the speed regulation system checks for any tampering condition to the speed regulating system. If a tampering has happened to the speed regulation system at step 703 a regired action is taken. The required action in case of speed regulation system is forcing the engine to work in a limp mode by passing parameters relating to the limp mode activation to the engine control unit. At step 704, the data relating to tampering, causes for tampering are recorded on a built-in memory and is transmitted to a central server through one or more communication circuits.

[00144] If the speed regulation system is not tampered, at step 705 the actual speed of the vehicle is determined through various sensors internal to the speed regulation system and externally placed sensors. At step 706 the maximum speed limit for a particular time or zone with other control parameters are retrieved from various sensors placed externally to the vehicle and stored in the in-built memory inside the speed regulation circuit. At step 707, the actual speed of the vehicle is compared with the stored pre-set speed limit data along with the current acceleration and de-acceleration parameters. At step 708 an input voltage is received from the input means 709 and the input voltage is determined. The input means 709 can be a accelerator pedal or any electronic component built to perform the similar function of the accelerator pedal. At step 710, the pre-set speed limit is updated based on the one or more speed regulation factors such as terrain condition, weather condition etc.

[00145] At step 711, the speed regulation system checks if with the current speed and acceleration factors does the vehicle speed exceeds the pre-set speed limit. If yes then at step 719 the voltage to be reduced is determined and provided to the engine control unit so as to gradually decrease the speed of the vehicle and maintain the vehicle speed within the pre-set speed limit. At step 720 the required voltage to be reduced to bring the vehicle under the pre-set speed limit is transmitted to the voltage regulation circuit. At step 721 the regulated voltage is transmitted to the limping relay and at step 716 a regulated pedal voltage is transmitted to the engine control unit from the limping relay thereby reducing the speed of the vehicle with the regulated pedal voltage being provided to the engine control unit at step 717.

[00146] At step 711, the speed regulation system checks if with the current speed and acceleration factors does the vehicle speed exceeds the pre-set speed limit. If NO, then the speed regulating system checks if the cruise control is activated or deactivated at step 712. At step 712, if the cruise control is not activated, the speed regulation system records and transmits the data relating the same to the central server. At step 712, if the if the cruise control is activated the speed regulation system at step 713 determines the required

voltage to be added to increase the vehicle speed to the pre-set speed limit and transmitted to the voltage regulation circuit. At step 714 the additional voltage is added through the voltage regulation circuit and at step 715, extra voltage created by the voltage regulation circuit is added with the input pedal voltage and transmitted to the limping relay. At step 716, the regulated pedal voltage is transmitted to the engine control unit from the liming relay wherein the regulated output voltage is provided to the engine control unit at step 717. At step 716 the parameters and other parameters are recorded and the same data is communicated with the central server at step 718. After recording and communicating data at step 718 the speed regulation system at step 702 loops in to update the pre-set speed dynamically and regulate the speed of the vehicle based on one more speed regulation parameters.

[00147] FIG. 8A and 8B is graph chart illustrating a vehicle speed management and performance during a normal operational mode of the vehicle according to an embodiment of the present invention. During the speed control in co-ordination with the pre-set speed limit, the speed regulation system regulates the speed of the vehicle by providing increase in the voltage to the vehicle engine control unit in small multiple steps to accelerate and reach the pre-set speed limit. As compared with the built-in engine control unit, the speed management is achieved by providing full acceleration input to the vehicle engine and on reaching the pre-set speed the engine control unit decrease the acceleration to the engine to maintain the speed of the vehicle within the pre-set speed limit. The drawback of the method of maintaining the speed of the vehicle within the pre-set speed limit using built-in engine control unit is that the increase in speed is achieved by burning more fuel and decreasing the efficiency of the vehicle. Using the inbuilt speed and RPM management modules of the speed regulatory system as well as relying on the error functionality of the vehicle ECU, the speed is maintained well below the maximum allowed speed of the vehicle. This is intended to restrict users from tampering the device to fail the device objectives.

[00148] The graph of fig 8B indicates the speed of the vehicle under limp condition. During the limp condition the error mode of the engine control unit is activated by disconnecting the input means to the engine control unit. This enables the engine control unit to work in a limp mode where the driver of the vehicle will be unable to exceed the speed of the vehicle above a defined limp speed limit.

[00149] The foregoing description of the specific embodiments will so fully reveal the general nature of the embodiments herein that others can, by applying current knowledge, readily modify and/or adapt for various applications such specific embodiments without departing from the generic concept, and, therefore, such adaptations and modifications should and are intended to be comprehended within the meaning and range of equivalents of the disclosed embodiments. It is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation. Therefore, while the embodiments herein have been described in terms of preferred embodiments, those skilled in the art will recognize that the embodiments herein can be practiced with modification within the spirit and scope of the appended claims.

G) ADVANTAGES OF THE INVENTION

[00150] The various embodiments of the present invention provides a speed regulating system and method for limiting the cruising speed of the vehicle within a preset speed limit. The control on maximum speed not only gives more control over the driving but also reduces the impact of any accidents . This in turn ensure lesser accidents and more importantly less devastation of life and property in case of an accident.

[00151] The time based speed management feature of the disclosed invention enables to automatically regulate the speed of the vehicle depending on the time of a day. This is mostly helpful during night time when driver response becomes slow due to various factors like reduced visibility, sleepiness etc.

[00152] Further the control on maximum acceleration of the vehicle, especially at high speeds, not only gives more control over the driving but also makes driving very smooth as well as prevents rash driving. This effect of acceleration control creates a dynamic speed limiting effect which provides additional safety for the vehicle, driver and public at large.

[00153] The acceleration control and the speed limiting features controls the fuel input to the engine and hence a better combustion of fuel is achieved. This enhancement in fuel burning gives better fuel efficiency as well as reduces toxic emissions and especially emission of unburned fuel.

[00154] The clock used herein is a high energy efficient clock which is adapted to work with even the auxiliary power source as the main powering means may not be available and might require resetting of time stored in the clock

[00155] The standby battery provided as an alternative power source for the clock ensures that the speed regulating system t runs for a very long time (years at length) even if the vehicle's power is disconnected.

[00156] Apart from the safety and comfort features, using of the speed regulating system also provides benefits like driver behavior modification, improvement in fuel efficiency, dynamic speed limiting and reduced emissions.

[00157] The speed regulating system has a specialized logic which indentifies and customizes its operations to adjust to the various accelerator pedal models available and works without any special configuration.

[00158] The speed regulating system provide a tamper proofing feature which identifies removal of speed pulse, removal of main power to the system and reducing the vehicle's maximum speed to ensure the purpose of speed regulation is served. Also the system identifies opening of the casing even when the system is not powered up and going into a permanently identifiable error situation to refrain anybody from opening the casing and modifying any circuits.

[00159] The dynamic speed management features controls the acceleration and restricts the vehicle from over speeding depending on the external factors like road conditions, terrains and other interferences to easy driving.

[00160] The embodiments of the preset invention does not affect the vehicle's performance under normal conditions by providing the same accelerator pedal output voltage as the output voltage from speed regulatory system even though the control circuitry is serially connected to the accelerator pedal output.

[00161] The embodiments herein is adapted to be used on all types of vehicles using electronic accelerator pedals with single or dual output, which delivers different or same voltage depending on accelerator pedal position.

[00162] Although the embodiments herein are described with various specific embodiments, it will be obvious for a person skilled in the art to practice the invention with modifications. However, all such modifications are deemed to be within the scope of the claims. It is also to be understood that the following claims are intended to cover all of the generic and specific features of the embodiments described herein and all the statements of the scope of the embodiments which as a matter of language might be said to fall there between.

Date: 20-February -2012

Applicant

Place: Kochi

CLAIMS

What is claimed is:

1. A system for regulating a vehicle speed, the system comprising:
 - a memory unit to store a pre-set vehicle speed limit;
 - a speed set means to update the pre-set vehicle speed limit in the memory unit;
 - at least one input means to provide a voltage input to the speed regulating system;
 - a power management unit to regulate power distribution within the speed regulating system;
 - a main electronic circuit adapted to control and co-ordinate a plurality of components of the speed regulating system;
 - a sensor circuitry to detect one or more data signals from the plurality of components and transmit the data signals to the main electronic circuit;
 - a voltage modulation circuit to modulate a voltage from the power management unit based on one or more voltage modulation parameters provided by the main electronic circuit;
 - a voltage adder circuit to add the voltage from the voltage modulation circuit and the input voltage to create an output voltage;
 - a voltage regulation circuit to regulate the output voltage provided by the voltage adder circuit based on one or more voltage regulation parameters from the main electronic circuit; and
 - a limping relay to provide alternate supply of the output voltage to the vehicle Engine Control Unit (ECU);wherein the main electronic circuit regulates the output voltage to the vehicle ECU based on one or more pre-determined speed regulatory factors to control the vehicle speed within the preset speed limit.
2. The system of claim 1, wherein the one or more predetermined speed regulatory factors comprises at least one of a:
 - terrain parameters;

geographical parameters;
traffic congestion parameters;
zonal parameters;
time –related parameters;
vehicle driving conditions;
location-related parameters;
weather conditions;
vehicle load parameters;
vehicle engine temperature parameters; and
engine fluid parameters;
wherein the predetermined factors are transmitted to the speed regulating system through one of an external data sources, communication devices and sensor devices.

3. The system of claim 1, wherein the output voltage generated by the voltage adder circuit is a summation of the voltage input from the input means and a modulated voltage from the voltage modulation circuit.
4. The system of claim 1, further comprising at least one communication unit for transmitting and receiving data from one or more external data sources, wherein the one or more external data sources includes a mobile communication device, a sensor device or any compatible device adapted for capturing vehicle information and the pre-determined speed regulatory factors.
5. The system of claim 4, wherein the at least one communication unit is a wireless transmission medium or a wired transmission medium.
6. The system of claim 1, further comprising at least one real time clock to provide time-related functions; wherein the real time clock is re-set to a random time state when the speed regulating system is tampered or disengaged from the vehicle.

7. The system of claim 1, wherein the at least one input means comprises a multi channel accelerator pedal input or an auxiliary input adapted for providing an accelerator press voltage.
8. The system of claim 1, wherein at least input means is a direct voltage input or a simulation of the direct voltage input.
9. The system of claim 1, wherein the speed set means to update the preset vehicle speed is at least one of a manual means and a data sensor.
10. The system of claim 1, wherein the main electronic circuit is at least one of a digitally programmed micro-controller circuit or a built-in analog circuitry adapted to perform functions of the digitally programmed micro-controller circuit.
11. The system of claim 1, wherein the main electronic circuit includes a speed control algorithm to control the vehicle speed based on the one or more predetermined speed regulatory factors.
12. The system of claim 8, wherein the speed control algorithm is digitally programmed or hardwired programmed to the main electronic circuit.
13. The system of claim 1, wherein the sensor circuitry is at least one of a digital sensor circuitry or an analog sensor circuitry.
14. The system of claim 1, wherein the plurality of sensors transmitting the data signals to the sensor circuitry comprises at least one of a brake press sensor, a clutch press sensor, a speed sensor, a motion sensor, a rain detection sensor and a visual distance detection sensor .

15. The system of claim 1, wherein the sensor circuitry is an optically isolated pulse detector circuit connected to the main electronic circuit; wherein the pulse detector circuit detects a pulse count which is proportional to the actual speed of the vehicle.
16. The system of claim 1, wherein the voltage regulation circuit and voltage modulation circuit is at least one of an analog variable resistance circuit or a digital variable resistance circuit.
17. The system of claim 1, wherein the voltage modulation circuit generates a voltage in case of inadequate voltage input supply to maintain the speed of the vehicle within the pre-set vehicle speed limit.
18. The system of claim 1, wherein the voltage regulation circuit regulates the voltage from the voltage adder circuit to the limping relay based on the input parameters received from the main electronic circuit to the voltage regulation circuit.
19. The system of claim 1, wherein the voltage adder circuit is at least one of an analog voltage circuit or a digital voltage circuit.
20. The system of claim 1, wherein the limping relay is at least one of a multi channel analog electro-mechanical circuit or a solid state device to provide alternate supply of output voltage to the ECU of the vehicle.
21. The system of claim 1, wherein the main electronic circuit minimizes the vehicle speed during a power failure or a wire disconnection of the speed regulatory system by activating the a vehicle ECU error mode by creating a signal failure from the accelerator pedal; wherein the speed regulating system is serially connected to the accelerator pedal.

22. The system of claim 1 further comprising:
- a switch input means to enhance the maximum vehicle speed for a short period of time,
 - a box open identification switch to detect tampering,
 - a battery to operate independently in powering the box open identification switch and the power management unit,
 - a rechargeable power unit to charge the battery; and
 - a cruise control disengage circuit to deactivate a cruise control of the vehicle.
23. The system of claim 22, wherein the switch input means signals the main electronic circuit to compute a permissible pre-set vehicle speed limit.
24. The system of claim 22, wherein the box open identification switch is activated by opening a casing of the speed regulatory system or disengaging of the speed regulating system from the vehicle.
25. The system of claim 22, wherein the box open identification switch on activation re-sets the real time clock to the random time state.
26. The system of claim 1, wherein the main electronic circuit deactivates the cruise control on receiving a switch input or a switch input indicative of a brake press or a clutch press.
27. The system of claim 1, wherein the limping relay is adapted to disconnect the accelerator pedal voltage supply to the vehicle ECU when power to the speed regulatory system is not adequately provided or as commanded by the main electronic circuit under various tampering conditions or error conditions.
28. The system of claim 1, wherein the main electronic circuit on processing an error code indicative of the tampering instructs the voltage regulation circuit to minimize the output voltage to the vehicle ECU to regulate the engine rpm to

a level so that vehicle cannot go beyond the preset maximum vehicle speed limit.

29. The system of claim 1, wherein the speed regulatory system is arranged between an input and the vehicle ECU to regulate the voltage from the input means to the ECU to provide for at least one of a cruise control, terrain based speed control, geographical location based speed control, traffic congestion based speed control, zonal parameters based speed control, time-related based speed control, vehicle driving conditions based speed control, weather conditions based speed control, vehicle load parameters based speed control, vehicle engine temperature parameters based speed control and engine fluid parameters based speed control of the vehicle.
30. The system of claim 1, further comprising an output means to provide one of an audible output and a visual output indicative of the vehicle parameters detected by the main electronic circuit.
31. The system of claim 30, wherein the audible output means includes a buzzer or a speaker; and visual output includes one or more display units.
32. The system of claim 1, wherein a voltage generated during a fully pressed state, a partially pressed state and a non-pressed state of the accelerator pedal is recorded to prevent the output voltage going below or more than the working voltage levels of the accelerator pedal.
33. The system of claim 1, wherein the speed of the vehicle is controlled upon exceeding the preset vehicle speed limit by varying a throttle position voltage of the vehicle.
34. The system of claim 1, wherein the speed regulating system generates a brake switch signal and transmits the brake switch signal to the vehicle ECU on

exceeding a time interval of a predetermined duration to deactivate the cruise control and to keep the brake deactivated when the vehicle speed is above the maximum permitted speed limit.

35. The system of claim 1, wherein the speed regulating system is adapted to interact with one or more speed regulating systems installed in nearby vehicles to transmit alerts during a vehicle fault, accident or other automatically or manually generated fault conditions.

36. A method of regulating a vehicle speed, the method comprising steps of:
defining a pre-set vehicle speed limit;
updating the pre-set speed limit;
detecting an actual vehicle speed;
comparing the actual vehicle speed with the updated pre-set vehicle speed limit;
determining if the updated pre-set vehicle speed limit is greater than the actual vehicle speed;
activating a voltage adder circuit and voltage modulation circuit for increasing an voltage input to a voltage regulation circuit in conjunction with an accelerator pedal input voltage;
activating the voltage regulation circuit for increasing or reducing the voltage input from the voltage adder circuit to simulate a vehicle accelerator pedal;
and
monitoring the speed of the vehicle periodically and updating the pre-set vehicle speed limit through a main electronic circuit for speed regulation actions;
wherein the main electronic circuit processes signals corresponding to the vehicle speed and the pre-set speed to automatically regulate the actual vehicle speed based on a set of pre-determined speed regulatory factors.

37. The method of claim 36, wherein the one or more predetermined speed regulatory factors comprises at least one of a:

- terrain parameters;
- geographical parameters;
- traffic congestion parameters;
- zonal parameters;
- time -related parameters;
- vehicle driving conditions;
- location-related parameters;
- weather conditions;
- vehicle load parameters;
- vehicle engine temperature parameters; and
- engine fluid parameters;

wherein the predetermined factors are transmitted to the speed regulating system through one of an external data sources, communication devices and sensor devices..

38. The method of claim 36, further comprising detecting a tampering of the speed regulatory system on identifying an opening of a casing or disengaging of the speed regulating system from the vehicle; wherein the tampering results in at least one of:

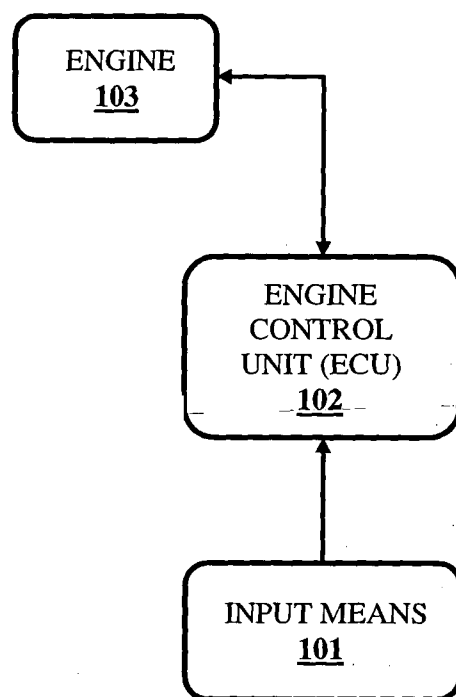
- re-setting of a real-time clock to a random timestate,
- transmitting a tampering alert to the main electronic circuit,
- transmitting a tampering related information through at least one of a communication unit to a central system,
- recording the tampering related information in a memory unit,
- transmitting an error code to the main electronic circuit which in turn reduces the voltage supply to the limping relay such that the vehicle operates in a limp mode.

39. The method of claim 38, wherein the limp mode is defined as a vehicle operational condition where the engine rpm is maintained at low levels so that the speed of the vehicle cannot exceed the maximum permitted speed limit unless the vehicle is passing a downhill.

Dated this 20th day of February, 2012

#74, 3rd Floor, 2nd Main, 3rd Cross,
East of Kathriguppa, Banashankari 3rd Stage,
4thPhase, Bangalore - 560 085 INDIA

To,
The Controller of Patents,
The Patent office,
At Chennai



[PRIOR-ART]

FIG. 1

NOBY
Applicant

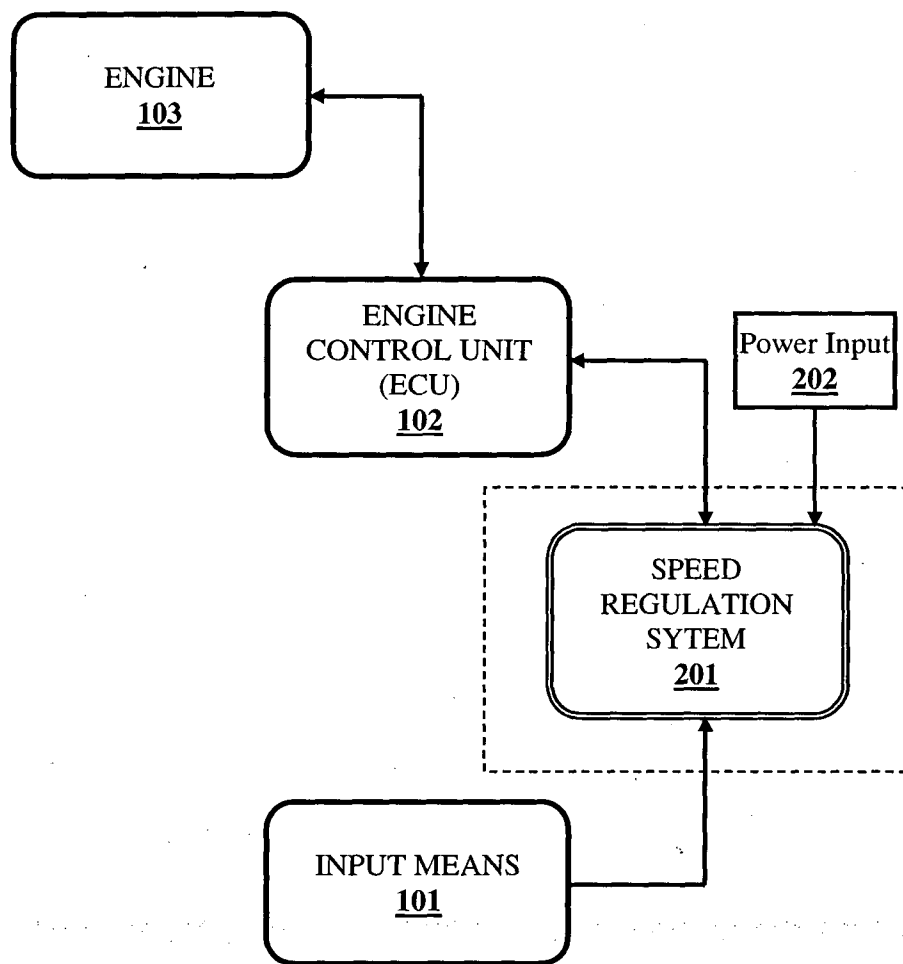
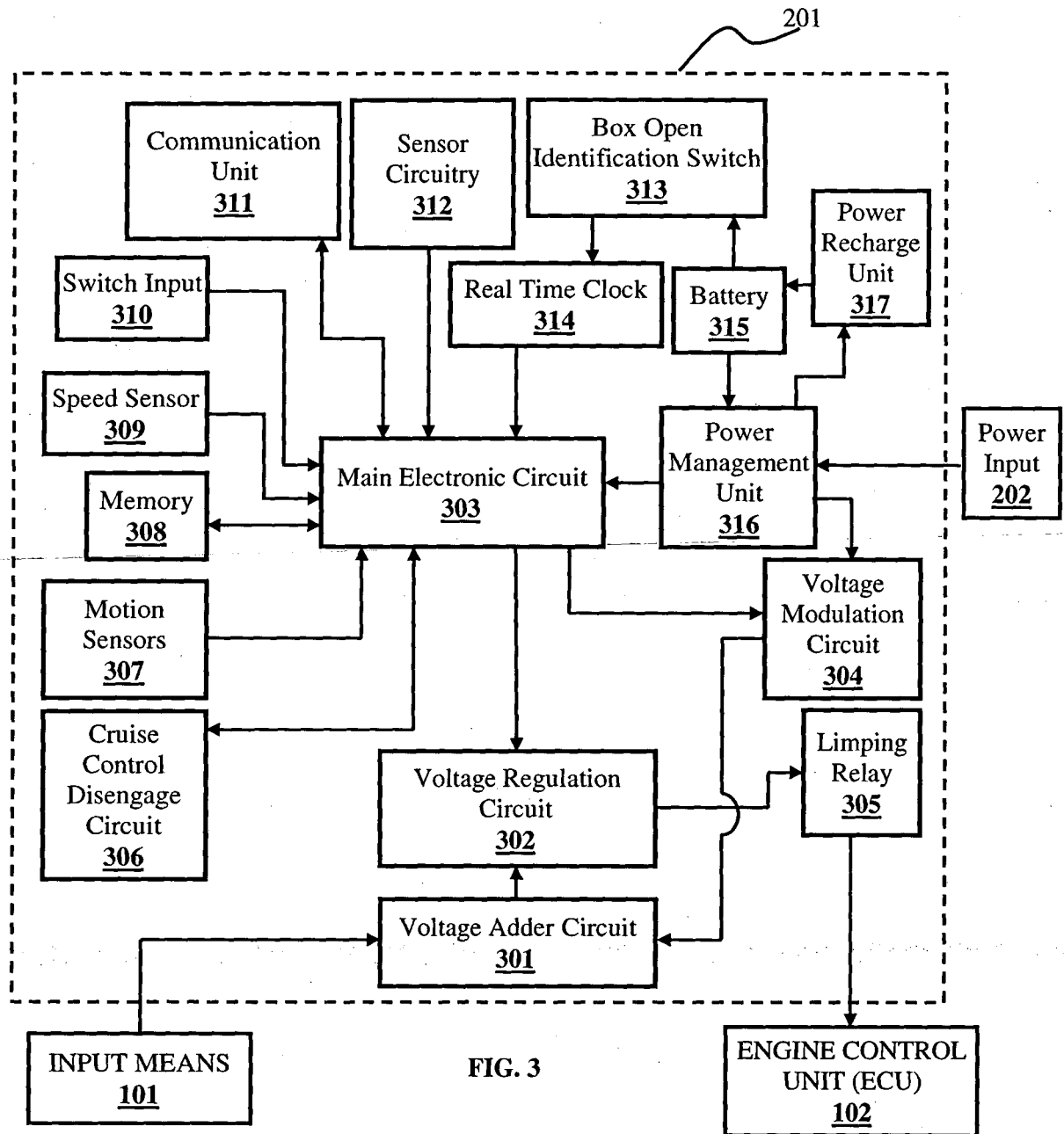


FIG. 2

NOBY
Applicant



NOBY
Applicant

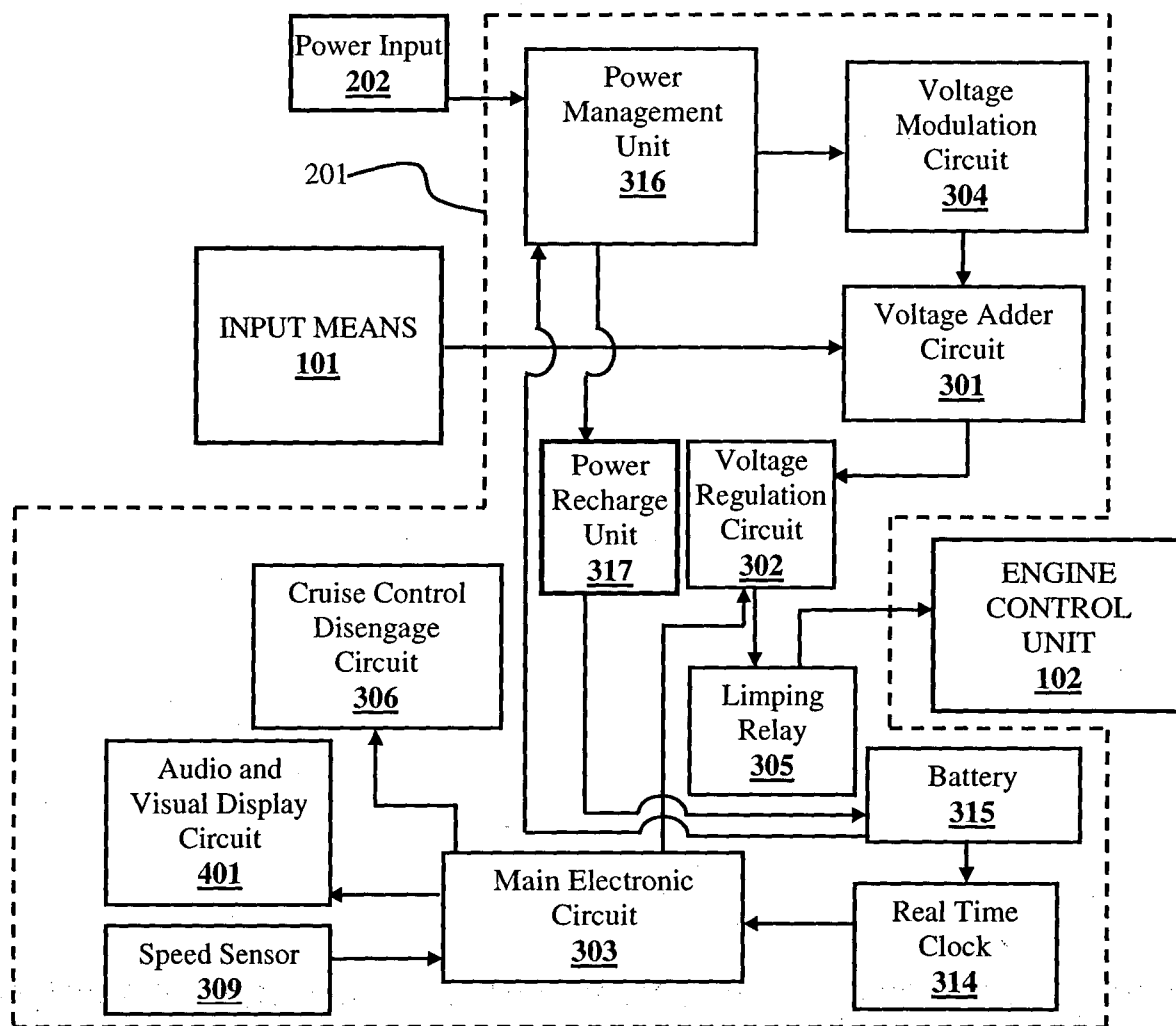


FIG. 4

NOBY
Applicant

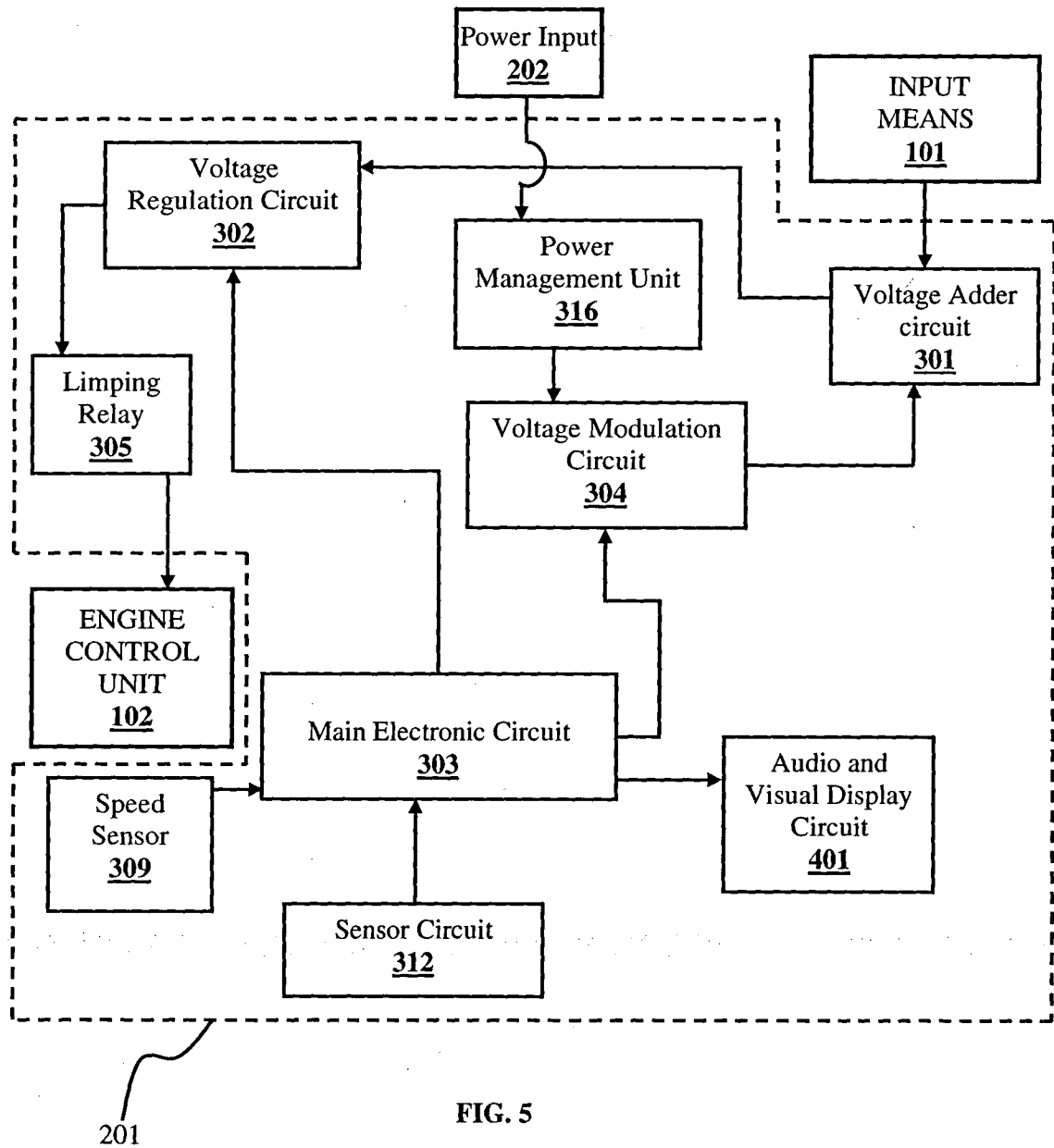


FIG. 5

NOBY
Applicant

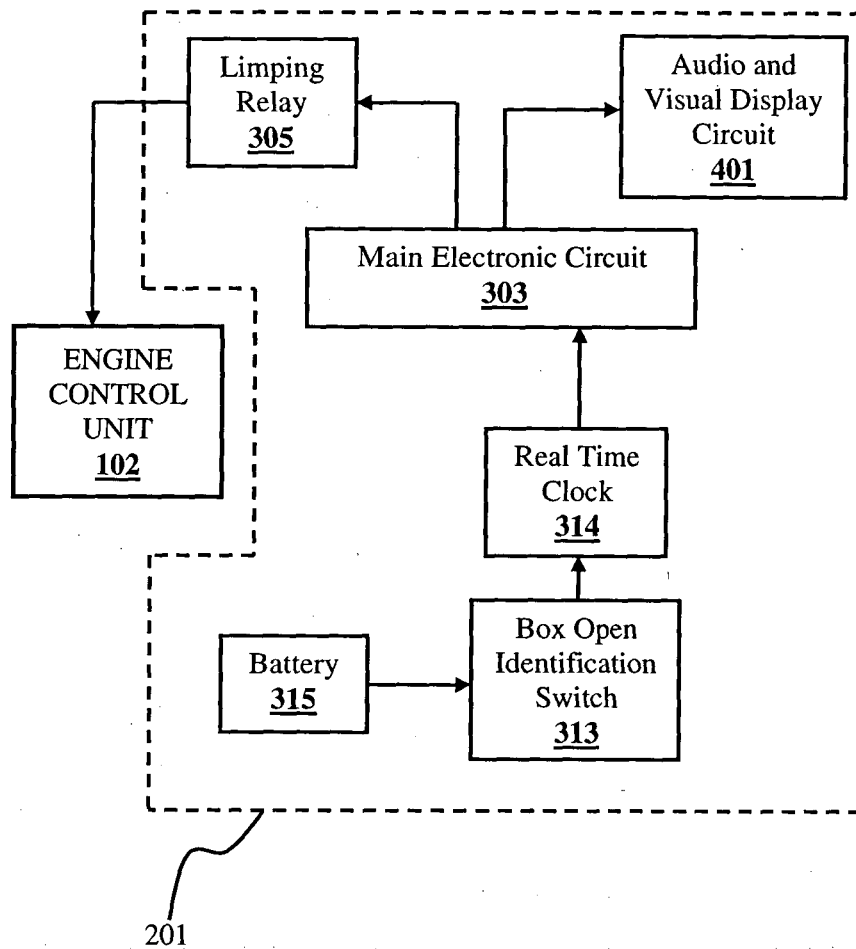
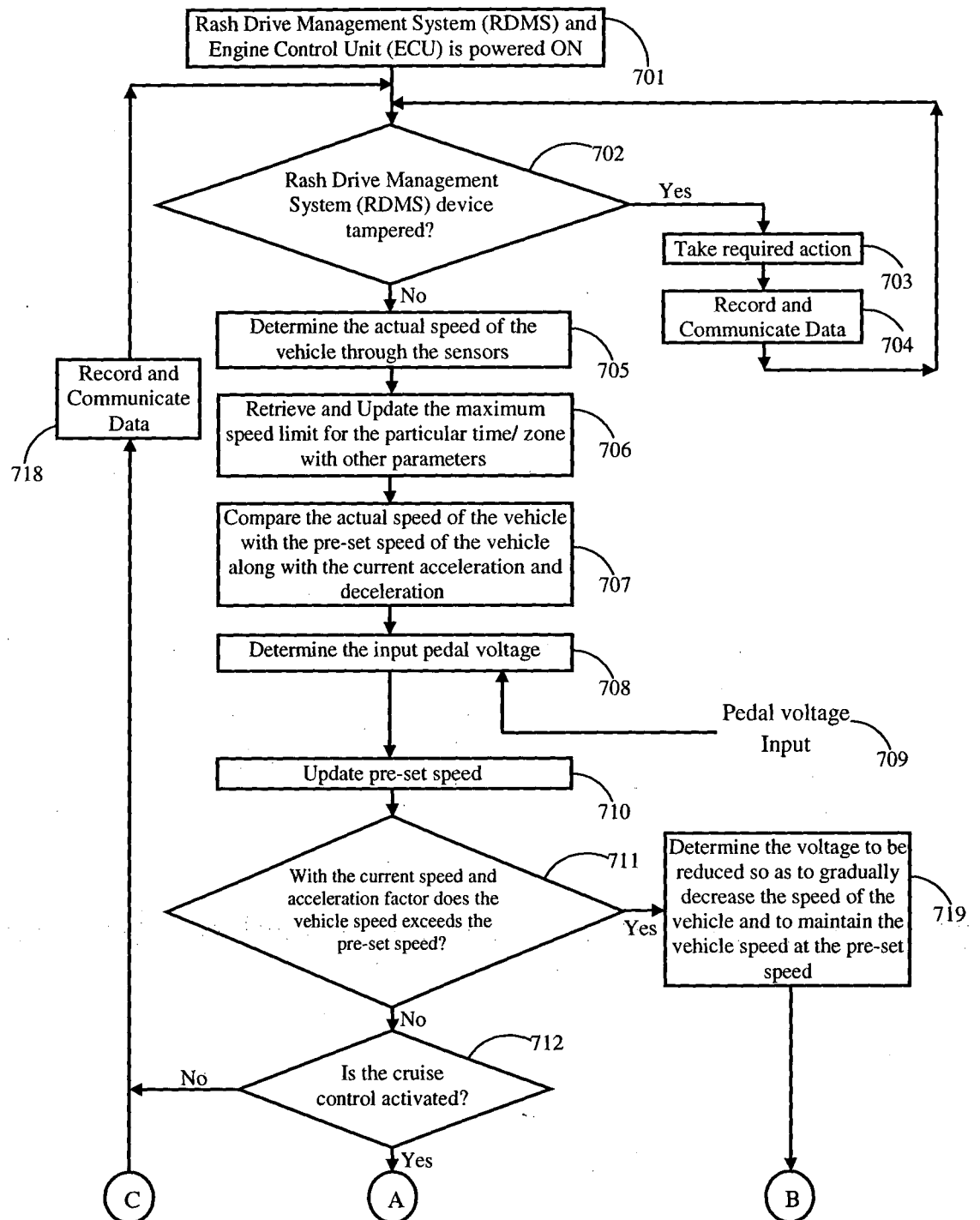


FIG. 6

NOBY
Applicant



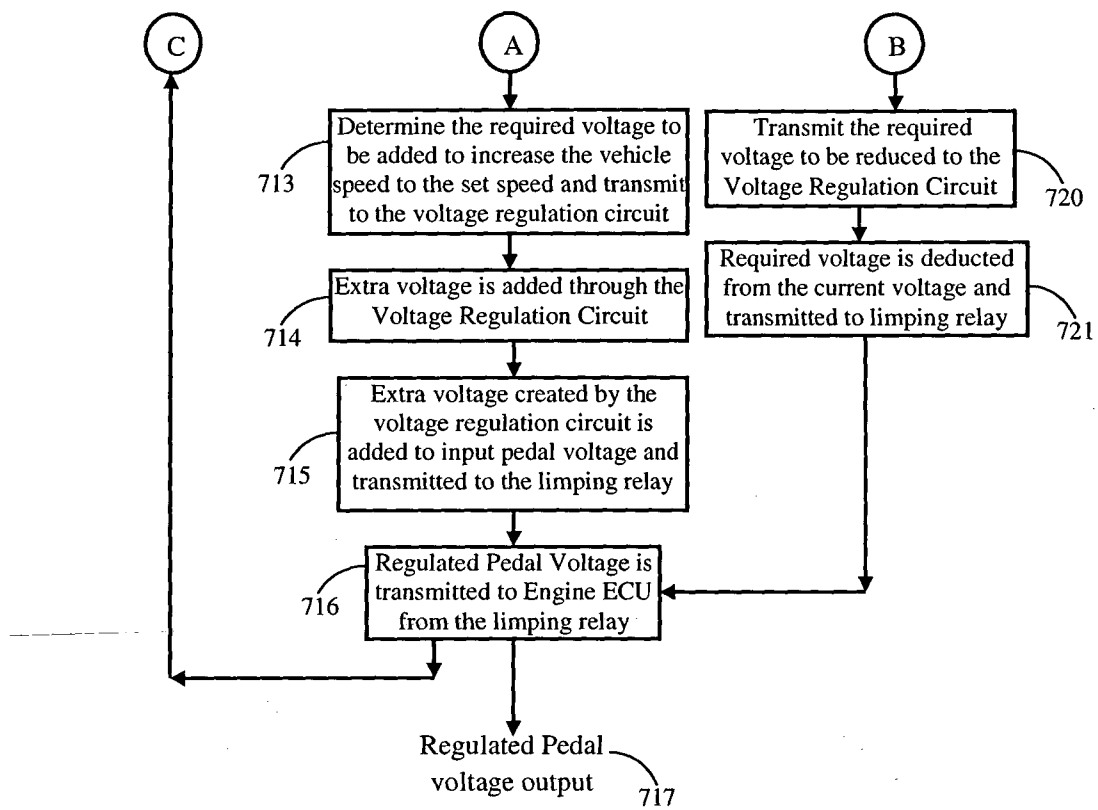


FIG. 7

NOBY
Applicant

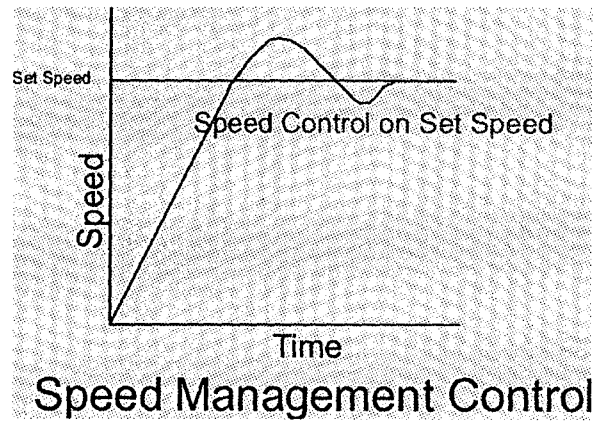


FIG. 8A

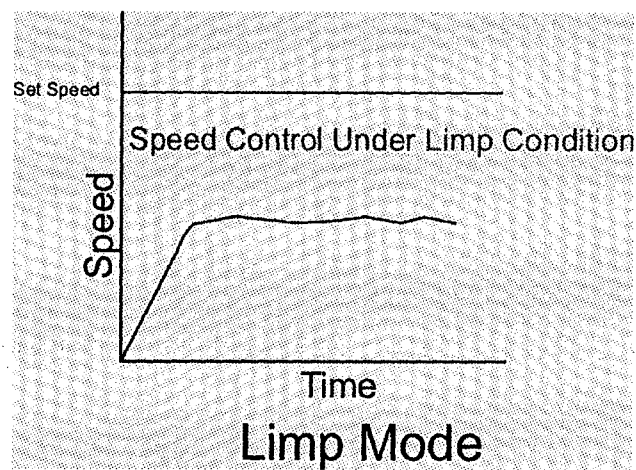


FIG. 8B

NOBY
Applicant