DEVICE TO MONITOR ENGINE PERFORMANCE AND BATTERY CONDITION

TECHNICAL FIELD

The present invention is related to a device to monitor key functions of engine performance and battery condition of an automotive vehicle.

BACKGROUND ART

Electrical circuitry designed to monitor battery condition of an automotive vehicle are known in the art. Electrical circuitry designed to monitor other parts of an automotive vehicle e.g. tire condition are also known in the art, as found in PCT/DE01/04827 .

Current inventions for monitoring engine performance of an automotive vehicle makes use of microprocessors and on-board computers. An example of this type of approach can be seen in EP 1 270 914 A2. However, these are too complex and too costly and often built into the automotive vehicle at time of manufacture, and not designed to be installed on-board after purchase of the automotive vehicle.

A number of known monitoring devices can be installed in automotive vehicles after purchase of the automotive vehicle. However, the disadvantage of these known monitoring devices is that these must be installed separately on an automotive vehicle in order for the motorist to have a good idea of how the automotive vehicle is performing. Reading the displays of information from a number of monitoring devices in a moving vehicle is not appropriate in busy road conditions.

It is desirable, therefore, to have an invention which offers a device with an integrated in-vehicle monitor and display unit linked to several key functions in the battery and the engine in an automotive vehicle. Such an integrated in-vehicle monitor and display unit should be easy to install on an automotive vehicle. The integrated in-vehicle monitor and display unit should therefore give the motorist a swift and easy visual

status on the proper performance of the key functions of an automotive vehicle and if there is any abnormal condition, which key function is not working properly, bearing in mind that the motorist is driving and has to pay attention to road conditions and vehicles around him. Preferably, the in vehicle monitor and display unit should give out aural warnings as well, so as to alert the driver especially in busy road conditions. Such an invention must also be low cost and yet effective in providing the driver with sufficient information on the performance of key functions of the battery and of the engine to be helpful.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a low cost device with an integrated centralized monitoring of the performance of a plurality of key functions of the battery and performance of the engine in an automotive vehicle.

It is a further object of the present invention to provide a low cost device with a single point current sensing for each function to identify normal and abnormal operating conditions relating to that function in an automotive vehicle and also to provide for means for feedback in terms of display of lights and musical alarm.

It is a further object of the present invention to provide a low cost device which can be installed easily on an automotive vehicle .

In carrying out the above objects and other objects and features of the present invention, a detecting means in the form of a electrical circuit to detect a condition of the battery or engine performance is provided for monitoring the operation of that condition. Each circuit requires a separate input and output current connected to the battery or component of the engine to be monitored. Each detecting means is capable of detecting a change in the output current and generates an output signal based on the change. The device also comprises display means and alarm means to give a plurality of visual and aural output signals depending on the condition of each function.

The above objects and other objects, features, and advantages of the present invention will be readily appreciated by one of ordinary skill in the art from the following detailed description of the best mode for carrying out the invention when taken in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the invention, its advantages, and the objects attained by its use, reference should now be made to the accompanying drawings. The accompanying drawings illustrate one or more embodiments of the invention and together with the description herein, serve to explain the workings and principles of the invention.

FIG. 1 is a circuit diagram of the circuit diagram of the device of the present invention.

FIG. 2 is a circuit diagram of a means to detect battery condition, the first function to be monitored in the device of the present invention.

FIG. 3 is a circuit diagram of a means to detect battery charging, the second function to be monitored in the device of the present invention.

FIG. 4 is a circuit diagram of a means to detect battery over charging, the third function to be monitored in the device of the present invention.

FIG. 5 is a circuit diagram of a means to detect engine temperature, the fourth function to be monitored in the device of the present invention.

FIG. 6 is a circuit diagram of a means to detect starter/solenoid status, the fifth function to be monitored in the device of the present invention.

FIG. 7 is a circuit diagram of a means to detect condition of spark plugs, the sixth function to be monitored in the device of the present invention.

FIG. 8 is a circuit diagram of a means to remind the driver of need to change timing belt, the seventh function to be monitored in the device of the present invention.

FIG. 9 is a diagrammatic representation of a type of in-vehicle monitor and display unit of the invention.

FIG. 10 is a diagrammatic representation of a type of in-vehicle monitor and display unit of the invention wherein the display of timing belt change is in digital display. .

BEST MODE FOR CARRYING OUT THE INVENTION

For purpose of illustration of the invention, the device described herein refers to an integrated in-vehicle monitor and display unit comprising several means, each capable of detecting an unique function of engine performance or battery condition. The several means to monitor key functions of the battery and engine is connected individually to the key function in the engine or battery and further connected to an in-vehicle monitor and display set. The device can be easily installed on automotive vehicles either by the motorist or at a garage.

A detailed description of the workings of each of the means for detecting a specific function of engine performance or battery condition is given now.

FIG. 1 is a overall circuit diagram of all the means of the present invention to monitor engine performance and battery condition.

FIG. 2 is a circuit diagram of a means to detect battery condition, the first function to be monitored by the device of the present invention.

The means to detect battery condition utilizes a Voltage Comparator which is a very sensitive and precise means for detecting changes in electric currents. Pin 2 and Pin 3 of the Voltage Comparator IC 7 are Inverting and Noninverting respectively. The unregulated +12V INPUT is connected to Pin 2

and Regulated +7V is connected to Pin 3. Resistor R19 is adjusted to a threshold point, assuming it is +1O Volt DC (engine start) for 0 Volt output Pin 6 of IC7.

As soon as the input V1 becomes slightly below Reference Voltage V_{ref} (i.e. the DC Input is below 10 Volts), the output rapidly changes to the positive supply voltage. As a result, IC8a output Pin 6 is 0 Volts, resulting in LED1 (Green) in the in-vehicle monitor and display unit being deactivated. IC8b output Pin 8 is +7V, thus activating LED2 RED in the in-vehicle monitor and display unit causing LED2 RED to flash and simultaneously activating Q1, IC3 (Timer) and IC5 (Music IC). As a result of the simultaneously activation of Q1, IC3 (Timer) and IC5 (Music IC), a musical alarm such as a melodious tune goes on to warn the motorist. Visual and Aural warnings are thus given out to the motorist in the automotive vehicle to alert the motorist that an abnormal condition has been detected. The motorist would then find out that the flashing of RED LED2 and output of Music indicates the battery is at the low stage of battery voltage and requires to be replaced.

Likewise, the voltage saturates at the negative supply voltage for any value V1 greater than the reference voltage V_{ref}, the output of IC7 Pin6 is 0 Volt and the output of IC8a Pin6 is +7 Volt, thus activating LED 1 GREEN in the in-vehicle monitor and display unit. The LED 1 Green on the in-vehicle monitor and display unit indicates the automobile battery is in normal state and LED 2 RED is deactivated.

FIG. 3 is a circuit diagram of a means to detect battery charging which is second function to be monitored by the device of the present invention.

Again, this circuit utilizes a Voltage Comparator IC13 to detect changes in electric current in battery charging. Resistor R35 is adjusted for 0 Volt at the output of IC13 Pin 6. The Input voltage is set at 14 Volts DC (i.e. charging voltage). The unregulated Input Power supply +12 Volt DC (i.e. no charging condition) is applied to Pin 2 (inverting) of IC13 and regulated +7V is applied Pin3 (non inverting) of IC 13.

Whenever the V4 voltage becomes slightly below reference voltage V_{ref} (i.e. the DC input is below 14 Volts DC), the output rapidly changes to positive supply voltage, and the output Pin 6 of IC14a becomes 0 Volt, therefore deactivating LED7 (GREEN) in the in-vehicle monitor and display unit and activates LED8 RED (Flashing), also in the in-vehicle monitor and display unit. Thus, LED7 Green signal goes off and LED8 Red signal comes on. At the same time, Q1, ICC3 and IC5 (Music IC) is activated and a musical alarm goes on in the form of a melodious tune, to warn the motorist. Thus, when no charging condition occurs, visual RED LED8 flashes is seen and Aural (Music IC) warnings is heard. These warnings indicate that the Automobile Battery is not charging or under charging. Likewise, when the voltage saturates at the negative supply for any value V4 greater than the reference voltage Vref, the output of IC13 pin 6 is 0 Volt. As a result, IC14a Pin 6 is +7VDC, resulting in LED 7 GREEN is activated and a green light on the in-vehicle monitor and display unit goes on. This indicates that the Battery charging system is NORMAL and the output of IC14b pin 8 is 0 volt. LED 8 RED is thus deactivated and there is no flashing red light in the in-vehicle monitor and display unit.

FIG. 4 is a circuit diagram of a means to detect battery over charging which is the third function to be monitored by the device of the present invention.

Again the means to detect battery overcharge includes a Voltage Comparator IC11 to detect changes in electric current in the battery. The reference voltage V_{ref} is applied to Pin 2 of IC11 and the regulated +7VDC is applied to Pin 2 of IC11, the unregulated +I2VDC is applied to Pin 3 of IC1 1. Resistor R30 is adjusted to the threshold point at +15VDC for an output Pin 6 of IC11 to 0 Volt DC. Assume the voltage at Pin 3 is slightly below the reference voltage, the output Pin 6 of IC11 is negative Voltage. The negative voltage then activates the LED 5 GREEN on the in-vehicle monitor and display unit. The green light shows the charging voltage is slightly below the pre-set voltage +I5VDC and deactivates LED 6 RED on the in-vehicle monitor and display unit. As soon as the charging voltage becomes slightly above +15VDC, the output Pin 6 of IC 11 become positive

voltage. As a result of output Pin 6 of IC 12a becomes negative to deactivate LED 5 GREEN and the output Pin 8 of IC 12b is positive voltage. LED 6 RED is thus activated and flashes on the in-vehicle monitor and display unit. Q1, IC3 and 1C5 Music IC are simultaneously activated, and a musical alarm goes on in the form of a melodious tune, to alert the motorist. As a result, both Visual warning in the form of a flashing red light (RED LED 6) and Aural Music warnings in the form of a musical alarm are given out to the motorist. The flashing red lights and music show that the alternator is in an over charged condition.

FIG. 5 is a circuit diagram of a means to detect engine temperature, the fourth function to be monitored by the device of the present invention.

Again, the means to detect engine temperature includes a Voltage Comparator which consists of IC9, the +7VDC being connected to Pin 2 and Pin 3 of IC 9. Resistor R25 is adjusted to the threshold point at + 95 degree C for an output Pin 6 of IC 9 for 0 Volt DC. A thermistor is installed at the appropriate location in the Engine Section. As soon as the engine temperature increase more than 95 degree C, the thermistor resistance is reduced and the voltage at Pin 2 of IC 9 goes slightly below the reference voltage V_{ref}. The output Pin 6 of IC 9 becomes positive voltage and IC 10a output Pin 6 becomes negative, thus deactivating LED3 (Green) in the in-vehicle monitor and display unit. In the meantime, the output Pin 8 of IC10b changes to positive voltage, thus LED 4 (RED) in the in-vehicle monitor and display unit flashes. Simultaneously, Q1, IC3 and IC5 (music IC) becomes activated and a musical alarm in the form of a melodious tune goes on. As a result, both Visual (LED4 Red light flashing) and Aural music warnings (musical alarm) goes on to alert the motorist. Likewise, if the Engine temperature remains below + 95 degree C, the Voltage at Pin2 of IC 9 is slightly greater than the reference voltage V_{ref}. The output Pin 6 of IC 9 becomes negative voltage and the output Pin 6 of IC10a becomes positive voltage and LED 3 GREEN is thus keep on in the in-vehicle monitor and display unit. The Green light indicates the condition of Engine Temperature is at a normal range. The output Pin8 of IC10b being 0 Volt DC deactivates LED4 (Red Light) on the in-vehicle monitor and display unit.

FIG. 6 is a circuit diagram of a means to detect starter/solenoid status, which is the fifth function to be monitored by the device of the present invention.

The means to detect starter/solenoid status is a circuit connected to the starter/solenoid assembly in the automotive vehicle. As soon as the Automobile is started, the circuit connected to the starter/solenoid assembly is formed and the LED 9 GREEN must be illuminated momentarily on the in-vehicle monitor and display unit whenever the engine is started. This shows that solenoid contacts have been made satisfactorily.

FIG. 7 is a circuit diagram of a means to detect condition of spark plugs, the sixth function to be monitored by the device of the present invention.

A coupling signal is picked up from each of the Spark plugs and each signal triggers a corresponding monostables IC I5, IC 16, IC 17, IC 18 (assuming there are four spark plugs in the engine of the automotive vehicle). The signal then activates a corresponding LED 11 GREEN (corresponding to Spark Plug 1), LED 12 GREEN (corresponding to Spark Plug 2), LED 13 GREEN (corresponding to Spark Plug 3) and LED 14 GREEN (corresponding to Spark Plug 4) respectively. The Mono-stable circuits show the actual performances of the Spark Plugs. Where the spark plug is functioning normally, the LED GREEN 11, LED GREEN 12, LED GREEN 13 and LED GREEN 14 would be flashing continuously. Where the automotive vehicles have six spark plugs or twelve spark plugs, the corresponding number of monostables are provided. Likewise, the corresponding number of LED GREEN would be flashing continuously when the spark plugs are functioning normally.

Where a spark plug is not functioning properly, the corresponding LED Green light in the monitor and display unit goes off. Once there is no LED Green light, the motorist would be notified as the in-vehicle display unit would show one of the LED Green lights as off.

FIG. 8 is a circuit diagram of a means to remind the driver of need to change timing belt, which is the seventh function of the device of the present invention.

Whenever the Automobile DC Power is switched "ON", a + 12 Volt DC is applied to IC1 and IC 2. After a time lapse of approximately 15 minutes, IC2 output is positive voltage. This causes Q1 to activate and the relay RL 1 is energised. As a result, IC3, IC5 (music IC) and IC 6 are activated. This causes LED 15 Red in the monitor and display unit to flash and aural music from IC 5 in the form of a musical alarm to go on. Visual and aural music warnings are then given to remind the driver to look on the Kilometer display in the Monitor and Display Panel indicating the distance in kilometers for the next replacement of timing belt. In the case of the timing belt change reminder, the warning will last approximately 5 seconds and then the warning would be cut off.

FIG. 9 is an illustration of a monitor and display unit of the invention. The monitor and display unit is installed in the passenger compartment, preferably on the driver's side or in front of the driver. The monitor and display unit is connected to the several circuits, each circuit individually connected to the battery, alternator, engine, spark plugs, starter/solenoid in an automotive vehicle. The monitor and display unit would give the motorist an integrated perspective of the condition of several key functions of the engine's performance and condition of the battery. To enable the motorist to keep his attention on the road, the monitor and display unit would not only give off a red flashing light to indicate which of the key functions is malfunctioning but also give off a musical alarm, to further alert the motorist in case he does not see the flashing red light.

The Monitor and Display Panel could also give a readout in digital form. FIG. 10 is an illustration of a monitor and display unit of the invention with readout in digital form. However, the circuit diagrams have to be modified appropriately for this.

It is to be understood, of course, that while the forms of the invention described above constitute the preferred embodiments of the invention, the preceding description is not intended to illustrate all possible forms thereof. It is also to be understood that the words used are words of description, rather than limitation, and that various changes may be made without departing from the spirit and scope of the invention, which should be construed according to the following claims.

ADVANTAGEOUS EFFECTS OF THE INVENTION

A monitor and display unit connected to the several circuits, each circuit individually connected to the battery, alternator, engine, spark plugs, starter/solenoid in an automotive vehicle to give the motorist an integrated perspective of the condition of several key functions of the engine and battery. To enable the motorist to keep his attention on the road, the monitor and display unit would not only give off a red flashing light to indicate which of the key functions is malfunctioning but also give off a musical alarm, to further alert the motorist in case he does not see the flashing red light.

CLAIMS

1. A device to monitor condition of a battery and engine performance in an automotive vehicle, the device having :-

means to detect condition of a battery;

means to detect condition of battery charging;

means to detect condition of battery over charging;

means to detect condition of starter/solenoid;

means to detect condition of spark plugs;

means to detect condition of overheating in the engine;

reminder means on change of timing belt; and

a monitor and display unit

characterized by the means to detect condition of battery, battery charging, over charging, starter/solenoid, spark plugs, overheating and reminder means on change of timing belt are connected to the battery, engine, starter/solenoid and spark plugs and to a monitor and display unit in an automotive vehicle whereby when a normal condition of each function is detected, the monitor and display unit shows a normal condition is detected and when an abnormal condition is detected, the monitor and display unit would only show the detection of an abnormal condition only in respect of the said abnormal condition.

2. A means to detect condition of a battery in the device to monitor condition of a battery in an automotive vehicle as claimed in Claim 1, the means to detect condition of the battery having a circuit comprising a voltage comparator connected to the battery, a resistor, a LED2 RED and LED1 GREEN.

3. A means to detect condition of battery charging in the device to monitor condition of a battery in an automotive vehicle as claimed in Claim 1, the means to detect condition of battery charging having a circuit comprising a voltage comparator connected to the battery, a resistor, a LED 8 RED and LED 7 GREEN.

4. A means to detect condition of battery overcharging in the device to monitor condition of a battery in an automotive vehicle as claimed in Claim 1, the means to detect condition of over charging having a circuit comprising a voltage comparator connected to the battery, a resistor, a LED 6 RED and LED 5 GREEN.

5. A means to detect condition of starter/solenoid in the device to monitor engine performance in an automotive vehicle as claimed in Claim 1, the means to detect condition of starter/solenoid having a circuit connected to the starter/solenoid assembly in the automotive vehicle and a LED 9 GREEN.

6. A means to detect condition of spark plugs in the device to monitor engine performance in an automotive vehicle as claimed in Claim 1, the means to detect condition of spark plugs having a circuit which detects a coupling signal from each spark plug, said coupling signal triggers a corresponding monostable circuit and activates a corresponding LED GREEN when the spark plug is functioning and when the spark plug is not functioning, the said means to detect condition of spark plugs would not detect the coupling signal to trigger the said corresponding monostable circuit and the corresponding LED GREEN is not switch on, thereby showing that the said spark plug is not functioning.

7. A means to detect condition of overheating in the engine in the device to monitor engine performance in an automotive vehicle as claimed in Claim 1, the means to detect condition of overheating in the engine having a circuit connected to a voltage comparator, a resistor, a thermistor adjusted to 95 degree C and located in an appropriate location in the engine section.

8. A reminder means on change of timing belt in the device to monitor engine performance in an automotive vehicle as claimed in Claim 1, wherein when the automobile DC Power is switched on, the warning means goes on to remind the driver to look the Kilometer display in the Monitor and Display Panel which shows the distance for the next replacement of timing belt.

9. A monitor and display unit in the device to monitor battery condition and engine performance in an automotive vehicle as claimed in Claim 1, the monitor and display unit having a circuit comprising Q1, IC3 and 1C5 Music IC connected to all the means to detect condition of battery, battery charging, over charging, starter/solenoid, overheating and reminder means on change of timing belt and to a monitor and display unit in an automotive vehicle and when the condition is normal, the LED GREEN light would be shown in the monitor and display unit for each of the means and when the said condition is not normal, the LED GREEN light goes off and the LED RED light flashes in the monitor and display unit for that condition and at the same time, a musical alarm goes on.

10. A device to monitor condition of a battery and engine performance in an automotive vehicle as claimed in Claim 1, the device being sold in the form of a kit having :-

means to detect condition of a battery;

means to detect condition of battery charging;

means to detect condition of battery over charging;

means to detect condition of starter/solenoid;

means to detect condition of spark plugs;

means to detect condition of overheating in the engine;

reminder means on change of timing belt; and

monitor and display unit;

for installation in an automotive vehicle.