(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
02 May 2024 (02.05.2024)

WIPO | PCT

(10) International Publication Number
WO 2024/089708 A1

(51) International Patent Classification:
G07C 5/08 (2006.01) *B60W 50/08* (2020.01)
B60L 58/10 (2019.01)

(21) International Application Number:
PCT/IN2023/050983

(22) International Filing Date:
26 October 2023 (26.10.2023)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
202241061004 26 October 2022 (26.10.2022) IN

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(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, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CV, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IQ, IR, IS, IT, JM, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, MG, MK, MN, MU, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, CV, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SC, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, 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, ME, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

(54) Title: METHOD AND SYSTEM FOR ALARMING USER OF A VEHICLE

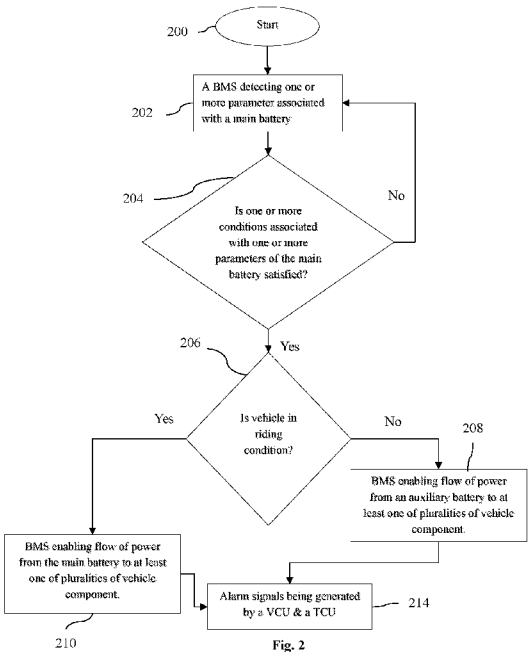


Fig. 2

(57) Abstract: The present disclosure provides a method and a vehicle to generate alarm signals for alarming a user relating a malfunctioning main battery (102). The present disclosure provides a BMS (104) which is configured to selectively enable flow of power from an auxiliary battery (106) or the main battery (102) to the at least one of the pluralities of vehicle component (118,120,122, 124). The BMS (104) selectively enables the flow of power based on riding condition of the vehicle and when one or more conditions associated with one or more parameters are satisfied. The flow of power to the at least one of the pluralities of vehicle component (118,120,122, 124) generates an alarm signal for the user, the surrounding vicinity of the vehicle, and other emergency contacts of the vehicle and the user.

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[Continued on next page]

Declarations under Rule 4.17:

— *as to the identity of the inventor (Rule 4.17(i))*

— *of inventorship (Rule 4.17(iv))*

Published:

— *with international search report (Art. 21(3))*

METHOD AND SYSTEM FOR ALARMING USER OF A VEHICLE

FIELD OF THE INVENTION

[0001] The present subject matter is related, in general to a vehicle configured to alarm a user, and more particularly to a method and a vehicle to alarm a user based on one or more conditions associated with one or parameters of a main battery in the vehicle.

BACKGROUND OF THE INVENTION

[0002] An electric vehicle is powered by a main battery, which stores a huge amount of chemical energy. The chemical energy of the main battery is converted into an electrical energy to power the vehicle. Under normal circumstances, main battery releases power in a controlled manner which is sufficient to drive the vehicle as well as power all other pluralities of vehicle components. However, at times during abnormal circumstances the main battery may start to malfunction due to which the health of the main battery further deteriorates. The unhealthy main battery could probably lead to explosion, or fire in the vehicle causing a dangerous situation for the user as well as the surroundings. Thus, to avoid such situations it is extremely important to keep a check on the health of the main battery. Further, as per many government guidelines across the nations, it is a mandate for the automobile manufactures to alarm the user and people in the near vicinity relating the malfunction of the main battery to preventive measures against any such disastrous situation.

[0003] Usually, a battery management system (BMS) monitors plurality of parameters of the main battery such as battery state of charge (SOC), temperature, pressure, voltage etc. In case, an ignition of the vehicle is turned ON, a control unit can generate an alarm for the user when the main battery is is malfunctioning. In such as situation, the control unit uses the power from the malfunctioning main battery using the same faulty path to generate the alarm signal. However, this

further aggravates the malfunctioning of the main battery because the power from the main battery itself is used for alarming the users.

[0004] However, in case when the ignition of the vehicle is switched OFF, the BMS does not receive power from the main battery. Thus, the BMS would not be able to detect that the health of the main battery even if the the main battery is unstable. Hence, the vehicle would not be able to generate alarm signals due to lack of any active power supply for generating the alarm signals and detecting fault of the main battery. However, even if the BMS can detect the malfunctioning of the main battery, the alarm signals will not be generated due to lack of any active power supply from the main battery. Thus, such a situation poses a high danger for the user as well as the surrounding vicinity of the vehicle. State of the art fails to alarm the user by generating alarm signals in a safe, and efficient manner at all operating conditions of the vehicle.

[0005] Further limitations and disadvantages of conventional and traditional approaches will become apparent to a person skilled in the art, through comparison of described systems with some aspects of the present disclosure, as set forth in the remainder of the present application and with reference to the drawings.

SUMMARY

[0006] The foregoing summary is illustrative only and is not intended to be in any way limiting. In addition to the illustrative aspects, embodiments, and features described above, further aspects, embodiments, and features will become apparent by reference to the drawings and the following detailed description.

[0007] According to embodiments illustrated herein, a system for alarming user of a vehicle. The system comprises a main battery which is used to power the vehicle and plurality of vehicle components such as a vehicle control unit (VCU), plurality of lighting loads, instrument cluster; a telematics control unit (TCU). The VCU is an interface between various control units and receives inputs from plurality of sensors and other control unit. The plurality of lighting loads includes a headlamp, a brake lamp, a pair of indicators, flashers etc. These plurality of lighting loads can

be used a light a particular sequence to generate alarm signals. A separate light control module is implemented for generating such sequences. The vehicle also includes a battery management system (BMS) which monitors one or more parameters of the main battery. The one or more parameters includes the main battery state of charge (SOC), distance to empty charge of the main battery, energy consumption by the main battery, remaining charging time of the main battery. The BMS also monitors if at least one of main battery cell is disintegrated, or short circuit in the main battery, movement of the main battery beyond a predetermined value during an ignition OFF state. The BMS gets power from an auxiliary battery. The auxiliary battery is connected to the plurality of vehicle components through an auxiliary relay. The main battery is connected to the plurality of vehicle components through a main relay, a pre-charge relay, and a DC-DC convertor. The main relay acts a switch to turn on or off the main battery power line which powers the plurality of vehicle components. The pre-charge relay prevents in-rush current towards the plurality of vehicle components before the main relay is switched on. The DC-DC convertor enables stepping down of the high voltage from the main battery to a lower voltage value as needed for powering the plurality of vehicle components. The main battery supplies high voltage power to a motor, and a low voltage power to the plurality of vehicle components.

[0008] According to an embodiment illustrated herein, there is provided a method of generating alarm signals. The method is implemented by the BMS which is configured to selectively enable flow of power from the auxiliary battery or the main battery to the at least one of the pluralities of vehicle component. The BMS selectively enables the flow of power based on riding condition of the vehicle and when one or more conditions associated with one or more parameters are satisfied. The flow of power to the at least one of the pluralities of vehicle component generates an alarm signal for the user, the surrounding vicinity of the vehicle, and other emergency contacts of the vehicle and the user. The one or more conditions are when the voltage associated with the main battery is more than a first predetermined values of voltage, or a pressure associated with the main battery is more than a second predetermined value of pressure, or the temperature associated

with the main battery being more than a third predetermined values of temperature. The one or more conditions also includes at least one of main battery cell disintegration, or short circuit in the main battery, rate of movement of the main battery beyond a predetermined value during an ignition OFF state. When the vehicle is in riding condition and any one of the above-mentioned conditions are satisfied, the BMS enables flow of power to at least one of the pluralities of vehicle components to generate alarm signals. However, if the vehicle is in not in riding condition the BMS enables flow of power from the auxiliary battery to the at least one of the pluralities of vehicle component. The BMS is configured to control the operation of the auxiliary relay for enabling flow of power from the auxiliary battery to the at least one of the pluralities of vehicle component.

[0009] It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only.

BRIEF DESCRIPTION OF THE DRAWINGS

[00010] The present disclosure will become more fully understood from the detailed description given herein below and the accompanying drawings which are given by way of illustration only, and thus are not limitative of the present disclosure, and wherein

[00011] Figure 1 shows a block diagram of the vehicle architecture for alarming a user in accordance with an embodiment of the present disclosure.

[00012] Figure 2 shows a flow chart of method of alarming a user in accordance with an embodiment of the present disclosure.

DETAILED DESCRIPTION OF THE DRAWINGS

[00013] The present disclosure may be best understood with reference to the detailed figures and description set forth herein. Various embodiments are discussed below with reference to the figures. However, those skilled in the art will readily appreciate that the detailed descriptions given herein with respect to the figures are simply for explanatory purposes as the methods and systems may extend beyond the described embodiments. For example, the teachings presented, and the

needs of a particular application may yield multiple alternative and suitable approaches to implement the functionality of any detail described herein. Therefore, any approach may extend beyond the particular implementation choices in the following embodiments described and shown.

[00014] References to "one embodiment," "at least one embodiment," "an embodiment," "one example," "an example," "for example," and so on indicate that the embodiment(s) or example(s) may include a particular feature, structure, characteristic, property, element, or limitation but that not every embodiment or example necessarily includes that particular feature, structure, characteristic, property, element, or limitation. Further, repeated use of the phrase "in an embodiment" does not necessarily refer to the same embodiment.

[00015] The present disclosure now will be described more fully hereinafter with different embodiments. This disclosure may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather those embodiments are provided so that this disclosure will be thorough and complete, and fully convey the scope of the disclosure to those skilled in the art.

[00016] The object of the present subject matter is to provide vehicle and a method of generating alarm signal based on when one or more conditions associated with one or more parameters of the main battery are satisfied, irrespective of vehicle ON and OFF conditions.

[00017] Figure 1 shows a block diagram of the vehicle architecture for alarming a user in accordance with an embodiment of the present disclosure.

[00018] With reference to Figure 1, 100 denotes a system, 102 denotes a main battery, such as lithium ion battery, 104 denotes a battery management system (BMS), 106 denotes an auxiliary battery, 108 denotes an auxiliary relay, 110 denotes a main relay, 112 denotes a pre-charge relay, 114 denotes a motor, 116 denotes a DC-DC convertor, 118 denotes a vehicle control unit (VCU), 120 denotes

an instrument cluster, 122 denotes a telematics control unit (TCU), 124 denotes a plurality of lighting loads.

[00019] As per an embodiment of the present disclosure, the system (100) comprises a main battery (102) which is used to power the vehicle and plurality of vehicle components (118,120,122, 124). The plurality of vehicle components (118,120,122, 124) includes a vehicle control unit (VCU) (118), plurality of lighting loads (124), instrument cluster (120) and a telematics control unit (TCU) (122), a turn signal lamp (s) (not shown). The VCU (118) is an interface between other control units (not shown) of the vehicle, wherein the VCU (118) receives inputs from plurality of sensors (not shown) and other control units. The plurality of lighting loads (124) includes a headlamp (not shown), a brake lamp (not shown), a pair of indicators (not shown), flashers (not shown) etc. These plurality of lighting loads (124) to light at a particular sequence to generate alarm signals. A separate light control module (not shown) is implemented for generating such sequences in the plurality of lighting loads (124). The system (100) also includes a battery management system (BMS) (104) which monitors one or more parameters of the main battery (102). The one or more parameters includes the main battery (102) state of charge (SOC), distance to empty charge of the main battery (102), energy consumption by the main battery (102), remaining charging time of the main battery (102). The BMS (104) also monitors if at least one of main battery (102) cell is disintegrated, or short circuit in the main battery (102), rate of movement of the main battery (102) beyond a predetermined value during an ignition OFF state. The BMS (104) gets power from an auxiliary battery (106). The auxiliary battery (106) is also connected to the plurality of vehicle components (118,120,122, 124) through the auxiliary relay (108). The main battery (102) is connected to the plurality of vehicle components (118,120,122, 124) through a main relay (110), a pre-charge relay (112), and a DC-DC convertor (116). The main relay (110) acts a switch to turn on or off the main battery (102) power line which powers the plurality of vehicle components (118,120,122, 124). The pre-charge relay (112) prevents in-rush current towards the plurality of vehicle components before the main relay is switched on. The DC-DC convertor (116) enables stepping down of the high

voltage from the main battery (102) to a lower voltage value as needed for powering the plurality of vehicle components (118,120,122, 124). The main battery (102) supplies high voltage power to a motor (114), and a low voltage power to the plurality of vehicle components (118,120,122, 124).

[00020] Figure 2 shows a flow chart of method of alarming a user in accordance with an embodiment of the present disclosure. With reference to Figure 2, referral numerals 200-214 denotes the steps of method of alarming a user in accordance with an embodiment of the present disclosure.

[00021] At the start of the process at the step (200), at step 202 the BMS (104) detects one or more parameters of the main battery (102). Further at step 204, the BMS (104) detects if the one or more parameters of the main battery (102) satisfies one or more conditions associated with the main battery (102). The one or more conditions are a set of predetermined conditions associated with the one or more parameters of the main battery (102). The one more more condition includes at least one of main battery (102) cell disintegration, or short circuit in the main battery (102), rate of movement of the main battery (102) beyond a predetermined value during an ignition OFF state. For example, if the main battery is disconnected from the vehicle when the vehicle ignition is switched off, or if the vehicle is in moving condition when the ignition of the vehicle is in OFF condition. The one or more conditions are when the voltage associated with the main battery (102) is more than a first predetermined values of voltage, or a pressure associated with the main battery (102) is more than a second predetermined value of pressure, or the temperature associated with the main battery (102) being more than a third predetermined values of temperature.

[00022] In case, if one or more parameters of the main battery (102) satisfies the one or more conditions associated with one or more parameters, at step 206 the BMS (104) detects if the vehicle is in riding condition or not. If the vehicle is in riding condition, at step 210 the BMS (104) enables flow of power from the main battery (102) to the at least one of the pluralities of vehicle components (118,120,122, 124). However, in case the ignition of the vehicle is switched OFF

or even if the ignition of the vehicle is switched ON but the vehicle is not in riding condition, the BMS (104) switches ON the auxiliary relay (108), which enables flow of power from the auxiliary battery (106) to the at least one of the pluralities of vehicle components (118,120,122, 124).

[00023] For example, one or more conditions associated with the temperature parameter of the main battery (102), is the temperatures of the main battery (102) is beyond 60 °C. In such a situation, if the temperature of the main battery (102) crosses 60 °C, the BMS (104) detects the temperature parameter of the main battery (102) has satisfied the one or more conditions. Further as per another example, the cell voltage of the main battery has exceeded 4.15 v, or the pressure of the main battery has reached near to 50 PSI, in such a situation the BMS (104) detects the operating parameter of the main battery (102) has satisfied the one or more conditions. After this, the BMS (104) detects whether the vehicle is in riding condition or not. In case the ignition of the vehicle is switched OFF, the BMS (104) enables flow of power from the auxiliary battery (106) to the at least one of the pluralities of the vehicle components for generating alarm signals.

[00024] The alarm signals include the at least one of the pluralities of light loads starts operating a particular sequence, or a sound/tune being produced, a notification to the nearby service station or a notification to the user through an application in a mobile device. Such as the VCU (118) and the TCU (122) are configured to produce alarm signals, the alarm signals include producing sounds, flashing lights, display messages to a remote application through a mobile device, and alarming nearby service centres. Further, in case the ignition of the vehicle is switched ON and the vehicle is not in riding condition, the BMS (104) enables flow of power from the auxiliary battery (106) to the at least one of the pluralities of the vehicle components (118,120,122, 124) for generating alarm signals. However, in case the ignition of the vehicle is switched ON and the vehicle is in riding condition, the BMS (104) enables flow of power from the main battery (102) to the at least one of the pluralities of the vehicle components (118,120,122, 124) for generating alarm signals.

[00025] The claimed vehicle and the method for alerting the user being implemented by the BMS of the main battery pack ensures to protect the main battery pack and alert the user. When the power supply is shifted to the auxiliary battery pack then the power supply from the main battery pack is cut off thereby protecting from over voltage, over current. Whenever a thermal runaway is detected within the main battery pack based on measured voltage or measured current or measured temperature using sensors of the main battery then the power supply from the main battery is cut off.

[00026] Various embodiments of the disclosure provide method and device for alarming a user if the main battery (102) malfunctions. The disclosed embodiments encompass numerous advantages. The present invention as described above are not routine, conventional, or well understood in the art, as the present disclosure enable the following solutions to the existing problems in conventional technologies of generating alarm signals while the ignition of the vehicle is in OFF condition or when using the deteriorated the main battery (102) for generating alarm signals. The present disclosure enables generating the alarm signals using an alternative power path instead of using the power from the malfunctioning main battery (102) at every vehicle operating conditions. This prevents further deterioration of the main battery (102) and thus generates alarm signals efficiently without additionally deteriorating the situation. Further, in case the vehicle is in riding condition the BMS (104) does not abruptly stops the power flow from the main battery (102). This eliminates the scope of accident, or jerk that could be experienced by the user if the main battery (102) suddenly stops supplying power. Further, since the BMS (104) also monitors the rate of movement of the main battery (102), the BMS (104) is capable of generating the alarm signals if the rate of movement of the main battery (102) is beyond a predetermined value and the ignition of the vehicle is in OFF condition. Hence, the BMS (104) will assist in preventing theft or unauthorized access to the main battery (102). The present disclosure successfully overcomes the challenge of generating alarm signals for alarming the user while the main battery (102) is malfunctioning when the ignition of the vehicle is in OFF

condition. The present disclosure enables generating alarm signals for to prevent theft as well.

[00027] A description of an embodiment with several components in communication with other does not imply that all such components are required, On the contrary, a variety of optional components are described to illustrate the wide variety of possible embodiments of the disclosure.

[00028] Finally, the language used in the specification has been principally selected for readability and instructional purposes, and it may not have been selected to delineate or circumscribe the inventive subject matter and is therefore intended that the scope of the disclosure be limited not by this detailed description, but rather by any claims that issue on an application based here on. Accordingly, the embodiments of the present disclosure are intended to be illustrative, but not limiting, of the scope of the disclosure, which is set forth in the following claims.

[00029] While various aspects and embodiments have been disclosed herein, other aspects and embodiments will be apparent to those skilled in the art. The various aspects and embodiments disclosed herein are for purposes of illustration and are not intended to be limiting, with the true scope and spirit being indicated by the following claims.

[00030] While the present disclosure has been described with reference to certain embodiments, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted without departing from the scope of the present disclosure. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the present disclosure without departing from its scope. Therefore, it is intended that the present disclosure not be limited to the particular embodiment disclosed, but that the present disclosure will include all embodiments falling within the scope of the appended claims.

Claims

~~I~~/We claim:

1. A system (100) for alarming a user of a vehicle, the system (100) comprising:

a main battery (102), the main battery (102) being configured to power the vehicle and plurality of vehicle component (118,120,122, 124);

an auxiliary battery (106), the auxiliary battery (106) being configured to power at least one of the pluralities of vehicle component (118,120,122, 124);

a battery management system (BMS) (104), the BMS (104) being powered by the main battery (102) and the auxiliary battery (106),

the BMS (104) being configured to monitor the one or more parameter associated with the main battery (102),

wherein the BMS (104) being configured to selectively enable flow of power from the auxiliary battery (106) or the main battery (102) to the at least one of the pluralities of vehicle component (118,120,122, 124) based on riding condition of the vehicle and when one or more conditions associated with one or more parameters being satisfied.

2. The system (100) as claimed in claim 1, wherein the auxiliary battery (106) being configured to power the BMS (104) when an ignition of the vehicle is in ON condition and in OFF condition, and the main battery (102) being configured to power the BMS (104) when the ignition of the vehicle is in ON condition.

3. The system (100) as claimed in claim 1, wherein the BMS (104) being configured to enable flow of power from the auxiliary battery (106) to at

least one of the pluralities of vehicle component (118,120,122, 124) when the vehicle is not in riding condition; and the BMS (104) being configured to selectively enable flow of power from the main battery (102) to the at least one of the pluralities of vehicle component (118,120,122, 124) when the vehicle is in riding condition.

4. The system (100) as claimed in claim 1, wherein the auxiliary battery (106) being connected to the at least one of the pluralities of vehicle component (118,120,122, 124) through an auxiliary relay (108), wherein the BMS (104) being configured to control the operation of the auxiliary relay (108) for enabling flow of power from the auxiliary battery (106) to the at least one of the pluralities of vehicle component (118,120,122, 124).

5. The system (100) as claimed in claim 1, wherein the plurality of vehicle component (118,120,122, 124) includes a vehicle control unit (VCU) (118), a turn signal lamp (s) (124), an instrument cluster (120), and a telematics control unit (TCU) (122).

6. The system (100) as claimed in claim 5, wherein the VCU (118) and the TCU (122) being configured to produce alarm signals, the alarm signals include producing sounds, flashing lights, display messages to a remote application through a mobile device, and alarming nearby service centers.

7. The system (100) as claimed in claim 1, wherein the one or more conditions comprises at least one of the voltage associated with the main battery (102) being more than a first predetermined values of voltage, a pressure associated with the main battery (102) being more than a second predetermined values of pressure, or the temperature associated with the main battery (102) being more than a third predetermined values of temperature.

8. The system (100) as claimed in claim 1, wherein one or more conditions associated with one or more parameters includes at least one of main battery (102) cell disintegration, or short circuit in the main battery (102), rate of movement of the main battery (102) beyond a predetermined value during an ignition OFF state.

9. The system (100) as claimed in claim 1, wherein the one or more parameter of the main battery (102) includes the main battery (102) state of charge (SOC), distance to empty charge of the main battery (102), energy consumption by the main battery (102), remaining charging time of the main battery (102).

10. The system (100) as claimed in claim 1, wherein the main battery (102) being connected to the plurality of vehicle component (118,120,122, 124) through a main relay, a pre-charge relay and a DC-DC convertor.

11. A method of generating alarm signals, the method comprising the steps of:

detecting by a battery management system (BMS (104)), one or more parameter associated with a main battery (102);

detecting by the BMS (104), an ON and OFF state of an ignition of a vehicle, and a riding condition of the vehicle;

selectively enabling by the BMS (104), flow of power from an auxiliary battery (106) or the main battery (102) to at least one of a pluralities of vehicle component (118,120,122, 124), based on riding condition of the vehicle and when one or more conditions associated with one or more parameters being satisfied.

12. The method as claimed in claim 11, wherein the plurality of vehicle component (118,120,122, 124) includes a vehicle control unit (VCU) (118), a turn signal lamp (s) (124), an instrument cluster (120), and a telematics control unit (TCU) (122).

13. The method as claimed in claim 11, wherein the VCU (118) and the TCU (122) being configured to produce alarm signals, the alarm signals include producing sounds, flashing lights, display messages to a remote application through a mobile device, and alarming nearby service centers.

14. The method as claimed in claim 11, wherein the one or more conditions comprises at least one of the voltages associated with the main battery (102) being more than a first predetermined values of voltage, a pressure associated with the main battery (102) being more than a second predetermined values of pressure, or the temperature associated with the main battery (102) being more than a third predetermined values of temperature.

15. The method as claimed in claim 11, wherein one or more conditions associated with one or more parameters includes at least one of main battery (102) cell disintegration, or short circuit in the main battery (102), rate of movement of the main battery (102) beyond a predetermined value during an ignition OFF state.

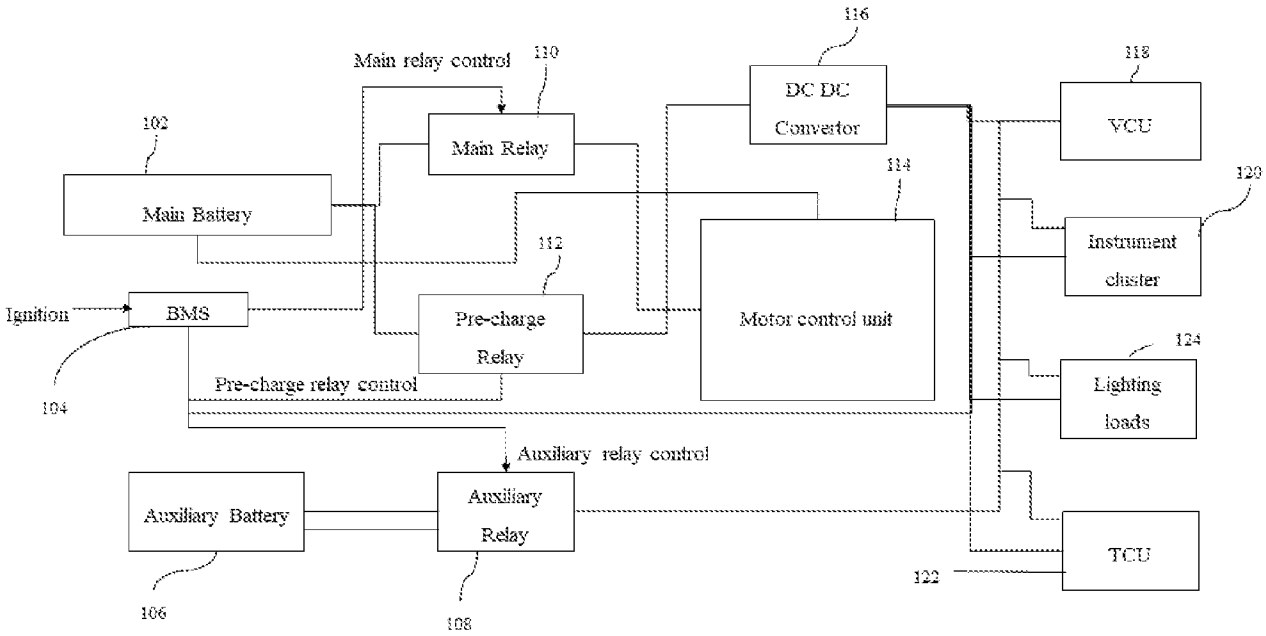

Main relay control
110
116
DC DC
Convertor
118
VCU
102
Main Relay
Main Battery
114
120
Instrument
cluster
112
Ignition
BMS
Pre-charge
Relay
Motor control unit
124
Lighting
loads
104
Pre-charge relay control
Auxiliary relay control
Auxiliary Battery
Auxiliary
Relay
TCU
122
106
108

Fig. 1

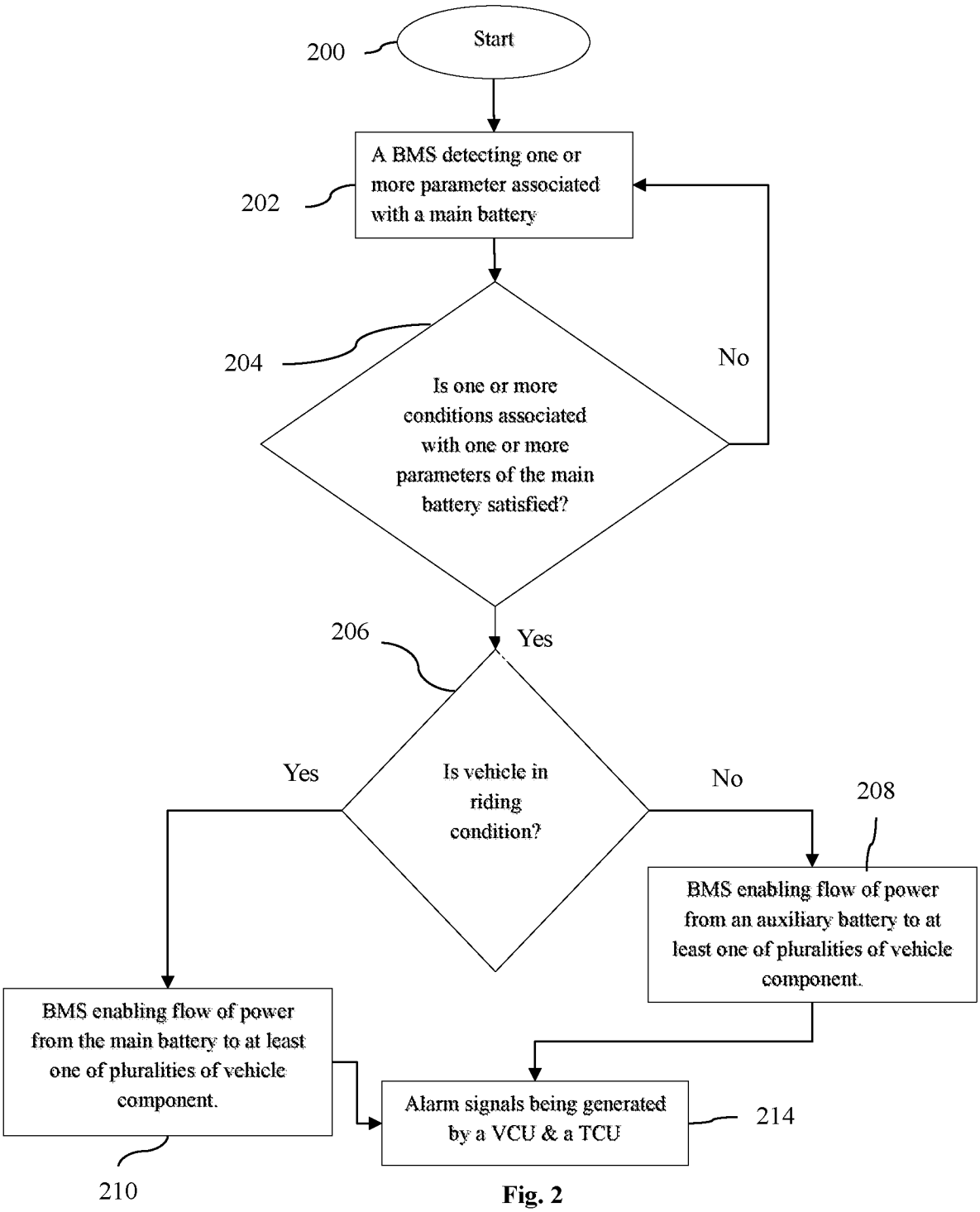

200
Start
A BMS detecting one or more parameter associated with a main battery
202
204
Is one or more conditions associated with one or more parameters of the main battery satisfied?
No
Yes
206
Is vehicle in riding condition?
Yes
No
208
BMS enabling flow of power from an auxiliary battery to at least one of pluralities of vehicle component.
BMS enabling flow of power from the main battery to at least one of pluralities of vehicle component.
210
Alarm signals being generated by a VCU & a TCU
214

Fig. 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IN2023/050983

A. CLASSIFICATION OF SUBJECT MATTER
G07C5/08,B60L58/10,B60W50/08 Version=2024.01

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G07C,B60L,B60W

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic database consulted during the international search (name of database and, where practicable, search terms used)

PatSeer, IPO Internal Database

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US20210221250A1 (Eletra Industrial Ltda) 22 July 2021 (22-07-2021) Abstract, Para 17-18,24-33,35-55, Claims 19-37	1-15
Y	CN202053906U (SHANGHAI RONGFU NEW ENERGY TECHNOLOGY Co Ltd) 30 November 2011 (30-11-2011) Abstract, Description, Claims 1-10 (English translation copy from Google Patents)	1-15

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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05-02-2024	05-02-2024
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INTERNATIONAL SEARCH REPORT
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International application No.
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Citation	Pub.Date	Family	Pub.Date
US 20210221250 A1	22-07-2021	WO 2019144205 A1	01-08-2019