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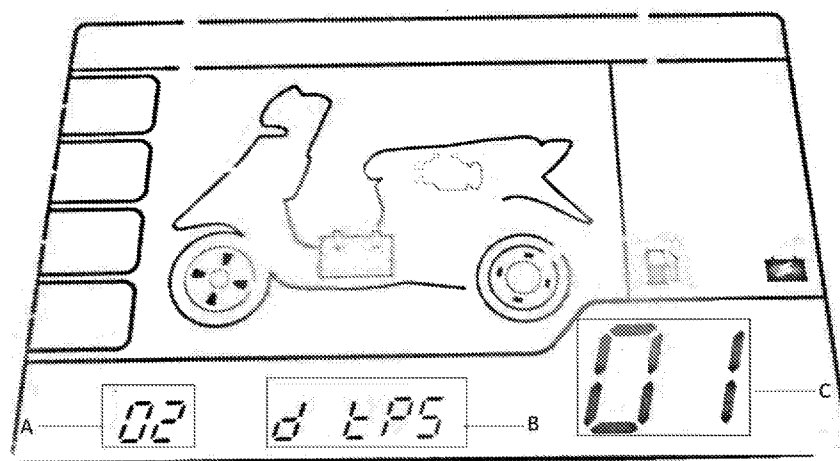


Fig. 5a

(57) Abstract: The present invention discloses a fault diagnostic system (100) for a vehicle (10) capable of displaying vehicle fault related information in the form of a fault message readable or referable to a look-up table by a vehicle operator. The vehicle fault related information is displayed by an instrument display cluster (102), which serves as a display module, only on receiving a predetermined display command, released on satisfaction of a set of predetermined criteria or on being triggered by the vehicle operator. The present invention further discloses a control method detailing the display of vehicle fault related information through the fault diagnostic system.



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**FAULT DIAGNOSTIC SYSTEM FOR A TWO-WHEELED VEHICLE
AND A CONTROL METHOD THEREOF**

Technical Field

5 **[1]** The present subject matter described herein generally relates to a fault diagnostic system for a two-wheeled vehicle and to a control method thereof.

Background

10 **[2]** Conventionally, on-board diagnostic systems/fault diagnostic systems were used in vehicles for providing fuel system related or emission related information the customers. However, over the years as the number of electrical and electronic systems in vehicles has increased, and the overall number of complex systems and sub systems has increased, on-board diagnostic systems in vehicles have come to used for providing any vehicle fault related information to the customer, and have
15 come to be largely used in all types of vehicles including hybrid vehicles, to facilitate the vehicle operator and service engineers/attendants to recognise easily and to facilitate convenient maintenance and monitoring of vehicle control systems. Thus, on-board diagnostics systems have become synonymous with fault diagnostics.

20 **[3]** Conventional fault diagnostic systems served to provide fault indication to the vehicle operators by means of LED lamps which glow/flash when fault is or by means of a fault alarm/beep alarm to alert the vehicle operator on detection a fault in the vehicle. However, LED lamps and fault alarms do not serve to be of much use especially when the vehicle reaches a service station for servicing,
25 the service engineer would be required to use a diagnostic tool for retrieving the fault related information, and which is in turn displayed on a computer. Therefore, the use of a computer is a must. Moreover, use of the diagnostic tool also requires the service engineer to constantly refer to standard operating procedure manuals in order to determine the fault. Thus, the use of conventional fault diagnostic
30 proves to be cumbersome.

[4] In order to overcome the above stated problems, a known art used in hybrid four wheeled vehicles provides a real time fault diagnostic system including a fault diagnosis interface, an information acquisition module, a storage module, a liquid crystal display module, a touch screen and keyboard module, a
5 main control module and a power source module. Particularly, said fault diagnostic system utilizes a CANopen master station for analysing and storing fault information, which is subsequently displayed on the fault diagnosis interface. However, storing of fault information for real time analysis of said information demands the use of a high performance processor for the control unit, which
10 proves to be costly. Moreover, use of a plurality of modules also leads to an overall increase in the complexity of the fault diagnostic system. Such a fault diagnostic system is therefore difficult to be used in small vehicles such as hybrid/electric two wheeled vehicles.

[5] There is therefore a need to provide two wheeled vehicles with an appropriate
15 fault diagnostic system, which is not only cost effective but also more convenient to use, involving fewer number of parts.

Summary of the Invention

- [6] The present invention has been made in view of the above circumstances.
- 20 [7] It is an object of the present invention to provide a fault diagnostic system for a two-wheeled vehicle which is capable of displaying vehicle fault related information using an instrument display cluster thereof as a fault diagnosis interface.
- [8] It is another object of the present invention to provide a fault diagnostic
25 system for a two-wheeled vehicle which is capable of displaying vehicle fault related information in the form of a fault message.
- [9] It is yet another object of the present invention to provide a fault diagnostic system for a two-wheeled vehicle which is cost effective.
- [10] It is one more object of the present invention to provide a fault
30 diagnostic system for a two-wheeled vehicle which is convenient to use and to decipher fault easily.

[11] It is still another object of the present invention to provide a fault diagnostic system which does not require the use of an additional diagnostic tool for deciphering vehicle fault related information.

[12] It is one more object of the present invention to provide a fault diagnostic
5 system which aids in reducing the time required by a service attendant for repairing faults and servicing the two-wheeled vehicle.

[13] Accordingly, with the above and other objects in view, the present invention provides a fault diagnostic system for a two-wheeled vehicle for identification of vehicle fault related information. Particularly, said fault
10 diagnostic system serves to display vehicle fault related information using an instrument display cluster of said two-wheeled vehicle as a fault diagnosis interface. As per an embodiment of the present invention, the fault diagnostic system includes an electronic control unit communicatively connected to said instrument display cluster, and a plurality of vehicle sensors capable of providing
15 vehicle related information to said electronic control unit. As per an implementation, said plurality of vehicle sensors are configured to provide vehicle fault related information besides providing other vehicle related information such as vehicle speed, fuel level, state of charge of battery etc. to said electronic control unit. Further, based on the vehicle fault related information received from the
20 plurality of vehicle sensors, the electronic control unit communicates the same to the instrument display cluster, which in turn displays said vehicle fault related information.

[14] As per an aspect of the present invention, the instrument display cluster is adapted to display said vehicle fault related information on receiving a
25 predetermined display command from the vehicle operator/service attendant. On receiving said predetermined display command, said instrument display cluster displays the vehicle fault related information in a readable form. For example, the instrument display cluster displays a fault message comprising the number of faults detected, a short text of faults detected, and a corresponding fault number
30 for each fault detected. Particularly, said readable form of the vehicle fault information is displayed when the predetermined display command is received by

the instrument display cluster. In the present embodiment, said predetermined display command is issued to the instrument display cluster when the vehicle operator/service attendant switches on a hazard switch followed by long pressing a vehicle push button such as a pass by button/boost button for a certain time interval. Additionally, the explanation of faults corresponding to fault numbers may be provided in a service manual. Thus, by merely referring to the service manual which contains a look-up table containing fault numbers with respective explanations of the fault that occurred in the vehicle, the service attendant may easily fix the faults in the vehicle and complete the servicing of the vehicle quickly.

[15] Thus, the present invention seeks to provide a means for retrieving vehicle fault related information on demand and as a result does not seek to store and process continuously, data relating to faults. Therefore, the fault diagnostic system as per the present invention does not require the use of a high performance processor in the electronic control unit. Moreover, since the instrument display cluster itself is used as the fault diagnosis interface, the need for additional diagnostic tools or other display modules such as liquid crystal displays for displaying the fault related information is eliminated. Further, since the short text of the faults detected along with the corresponding fault code is displayed, or said short text is provided in a look-up table in a service manual against corresponding fault numbers which are displayed on the instrument cluster, the overall time required for repairing the faults by a service attendant or a vehicle operator is reduced drastically.

[16] Further, the present invention also describes a method of operation of said fault diagnostic system especially that of said electronic control unit, and that of the instrument display cluster for effecting display of said vehicle fault related information.

[17] Summary provided above explains the basic features of the invention and does not limit the scope of the invention. The nature and further characteristic features of the present invention will be made clearer from the following descriptions made with reference to the accompanying drawings.

Brief Description of Drawings

[18] The above and other features, aspects, and advantages of the subject matter will be better understood with regard to the following description and
5 accompanying drawings where:

[19] FIG.1 is a schematic representation of a two-wheeled vehicle in accordance with an embodiment of the present invention.

[20] FIG.2 is a schematic representation of a fault diagnostic system in accordance with an embodiment of the present invention.

10 [21] FIG.3 illustrates a flow chart depicting steps of a method of functioning of an electronic control unit of the fault diagnostic system in accordance with an embodiment of the present invention.

[22] FIG.4 illustrates a flow chart depicting steps of a method of functioning of an instrument display cluster of said fault diagnostic system in accordance with
15 an embodiment of the present invention.

[23] FIG.5a illustrates a detailed front view of a portion of the instrument display cluster denoting a first fault message in accordance with an embodiment of the present invention.

[24] FIG.5b illustrates a front view of the instrument display cluster
20 denoting a second fault message in accordance with an embodiment of the present invention.

Detailed Description

[25] The present subject matter described herein relates to a fault diagnostic
25 system for a vehicle which serves to provide vehicle fault related information to a user. Particularly, said fault diagnostic system including an instrument display cluster serves to display to a user, vehicle fault related information besides other vehicular information such as vehicle speed, state of charge, fuel level, terrain on which vehicle is travelling and the like.

30 [26] Exemplary embodiments detailing features of the fault diagnostic system, in accordance with the present invention will be described hereunder. The

embodiments described herein apply to a vehicle powered by two or more power sources including an internal combustion engine, traction motor and a battery. However, the present invention is not restricted in its application and is also applicable to vehicles employing only the traction motor and the battery, say for example an electric vehicle. Further, although the present invention has been exemplified for a two-wheeled vehicle, application of the present invention need not be restricted to a two-wheeled vehicle, and maybe applied to any vehicle including three-wheeled and four-wheeled vehicles.

5 [27] The present invention has been exemplified for a hybrid vehicle as illustrated in FIG.1.

[28] With reference to FIG.1, a description is made of a hybrid two-wheeled vehicle, hereinafter "vehicle" 10 in accordance with an embodiment of the present invention. FIG.1 is a side view of said vehicle 10. Said vehicle 10 illustrated, has a step-through type frame assembly 15. The step-through type frame assembly 15 includes a head tube 15A, a main tube 15B and a pair of side tubes 15C. Particularly, the main tube 15B extends downwards from a rear portion of the head tube 15A and then extends rearwards in an inclined manner. Further, the pair of side tubes 15C extends rearwardly from the main tube 15B. Thus, the frame assembly 15 extends from a front portion F to rear a rear portion R of the vehicle.

15 [29] Said vehicle 10 further includes a plurality of body panels for covering the frame assembly 15, and is mounted thereto. In the present embodiment said plurality of body panels includes a front panel 15FP, a leg shield 15LS, an under-seat cover 15SC, and a left and a right side panel 15SP. Further, a glove box may be mounted to said leg shield 15LS.

20 [30] In a step through space formed between said leg shield 15LS and said under seat cover 15SC, a floorboard 12 is provided. Further, a seat assembly 25 is disposed above said under-seat cover 15SC, and is mounted to the pair of side tubes 15C. A utility box (not shown) is disposed below the seat assembly 25. A fuel tank (not shown) is positioned below the utility box. A rear fender 26 for covering at least a portion of a rear wheel 27 is positioned below the fuel tank.

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[31] One or more suspension(s)/shock absorbers **30** are provided in a rear portion of said vehicle **10** for comfortable ride. Further said vehicle **10** comprises of plurality of electrical and electronic components including a headlight **35A**, a taillight **35B**, a transistor controlled ignition (TCI) unit (not shown), a starter motor (not shown) and the like. A touch screen LCD unit in the form of an instrument display panel (not shown) is provided on a handle bar **11** to display various operating drive modes, power flow pattern and warning signals. Rear view mirrors **13** are mounted on the right and left sides of the handle bar **11**. Said vehicle **10** is also provided with hazard lamps (not shown).

10 [32] An internal combustion engine **14**, hereinafter "engine", is arranged behind said floorboard **12** and supported between the pair of side tubes **15C**. Particularly, said engine **14** is supported by a swing arm **19**. The swing arm **19** is attached to a lower portion of the main tube **15B** by means of a toggle link (not shown). The other end of the swing arm **19** holds the rear wheel **27**. The rear wheel **27** and the swing arm **19** are connected to the pair of side frames **15C** by means of a pair of shock absorbers **30** provided on either side of the vehicle.

15 [33] Said hybrid vehicle **10** further includes a traction motor **53** mounted on a hub of the rear wheel **27**. Said traction motor **53** is powered by a battery (not shown) disposed in a rear portion of the vehicle. An electronic control unit **102** (shown in FIG.2) is also provided to control various vehicle operative modes.

20 [34] The hybrid vehicle **10** is configured to be propelled either by the engine **14** alone or by the traction motor **53** alone or by both engine **14** and traction motor **53** simultaneously. At zero vehicle speed, a rider can select any of the following four operating drive modes with the help of a mode switch. The four operating drive modes of the hybrid vehicle **10** are: (a) a sole engine mode where engine **14** alone powers the vehicle (b) a sole motor mode where the traction motor **53** alone powers the vehicle (c) a hybrid power mode wherein the engine **14** and the traction motor **53** together power the vehicle (d) a hybrid economy mode wherein only the engine **14** or only the traction motor **53** or both power the hybrid vehicle
25
30 depending on the vehicle operating conditions.

[35] In other words, the rear wheel **27** of the vehicle is driven by either the engine **14** alone or by the motor **53** alone or by both the engine **14** and the motor **53** simultaneously. Particularly, power from the engine **14** to the rear wheel **27** is transmitted by a transmission assembly including a drive system (not shown) as per an embodiment of the present invention. However, when the traction motor **53** drives, power from the motor **53** is directly transmitted to the rear wheel **27**. In the present embodiment, said traction motor **53** is covered by a motor shroud from at least one side. As per an aspect of the present invention, said motor shroud serves to at least partially encompass/house one or more parts of the drive system and therefore constitutes a part of the drive system. On another side of the wheel shaft, the motor shroud serves to house a brake drum (not shown).

[36] Said vehicle **10** as described above includes a fault diagnostic system **100** as shown in **FIG.2**. **FIG.2** is a schematic block diagram denoting the fault diagnostic system as per an embodiment of the present invention. The fault diagnostic system as per the present invention includes an electronic control unit **101**, an instrument display cluster **102** communicatively connected to said electronic control unit **101**, and a plurality of vehicle sensors including throttle position sensor **103a**, one or more hall sensors **103b**, a current sensor **103c**, motor temperature sensor **103d** etc. operatively connected to the electronic control unit **101**. Further, the electronic control unit **101** is powered by a battery **104**, said battery **104** having its own controller, and which constitutes a part of the battery management system which sends and receives signals from and to the electronic control unit **101**. Information processed by a first microcontroller in the electronic control unit is communicated via controller area network (CAN) communication to the instrument display cluster **102**. For example, the first microcontroller processes a plurality of vehicle related information including vehicle fault related information based on the inputs provided by the plurality of vehicle sensors and communicates the same to the instrument display cluster. In the present embodiment, said instrument display cluster **102** includes a second microcontroller for processing information communicated by the electronic control unit **101**.

[37] As per an aspect of the present invention, the instrument display cluster 102 is configured to display vehicle fault related information to the vehicle operator/a service attendant. Particularly, said instrument display cluster 102 is configured to display said vehicle fault related information only on receiving a predetermined display command.

[38] FIG.3 and FIG.4 illustrate the steps involved in a method of operation of the electronic control unit 101 and that of the instrument display cluster 102 for effecting display of vehicle fault related information. Flowchart 200 in FIG.3 denotes the steps of operation of the electronic control unit 101 for detecting faults in the vehicle and signaling the same to the vehicle operator. Flowchart 300 in FIG.4 denotes the steps of operation of the instrument display cluster 102 in effecting the display of vehicle fault information.

[39] As may be seen in FIG.3, in a first step of its operation, in a condition where the ignition switch is ON, at block 201 the electronic control unit determines if initially any faults are detected in a standstill condition of said vehicle based on information received from said plurality of vehicle sensors. If fault is detected/present at block 202, the electronic control unit 101 sends a fault signal to the instrument display cluster 102. If fault is not detected/ present, the electronic control unit further waits for a throttle input and further determines if said throttle input received is greater than a predetermined threshold throttle input at block 203. If said throttle input received is greater than said predetermined threshold throttle input, the electronic control unit allows said vehicle to be powered in the existing drive mode, and further determines if in a running condition of said vehicle any fault is detected/ present at block 204. In a condition where fault is detected in a vehicle running condition, the electronic control unit sends a fault signal to the instrument display cluster which in turn results in a flash actuation of a fault indicator provided in the instrument display cluster at block 205. Thereafter, the electronic control unit at block 206 also determines if it is possible for said vehicle to run in an alternate drive mode. In a situation where there is no possibility for the vehicle to be operated in an alternate drive mode, the fault indicator would continue to glow in red, thereby indicating to the vehicle

operator that the vehicle is inoperable due to presence of one or more faults in the vehicle. However, if the electronic control unit determines that it is possible for the vehicle to run in an alternate drive mode, it will automatically cause a change in the drive mode and allow the vehicle to be operated.

5 **[40]** For example, in case where the electronic control unit **101** detects a fault in the battery of the vehicle and therefore in operation of an EV mode of said vehicle, the electronic control unit determines if operation of the vehicle in an alternate drive mode is possible. If the electronic control unit establishes that operation of the vehicle in an alternate drive mode such as a sole engine mode is possible, it causes a change in the drive mode to cause operation of the vehicle in an alternate drive mode such as sole engine mode.

10 **[41]** However, in a situation where operation of the vehicle in an alternate drive mode is also not possible, and it becomes necessary to subject the vehicle to repairs, the fault diagnostic system as per the present invention serves to assist a service attendant in easily recognising said one or more faults in the vehicle and thereby easily rectify said one or more faults. Particularly, the fault diagnostic system **100** as per the present invention, serves to display said vehicle fault related information in a readable format. In other words, said fault diagnostic system serves to display a fault message so as to facilitate easy comprehension of the faults in the vehicle by the service attendant. The fault message may be a short text briefly indicating the fault or it may be number, the corresponding explanation of which is placed in a service manual, in the form of a look-up table, which may be referred to by the service attendant.

15 **[42]** The fault diagnostic system as per the present invention uses the instrument display cluster as a fault diagnosis interface for displaying said fault message. In other words, said instrument display cluster **102** is configured to display said fault message. The flowchart **300** depicted in **FIG.4** illustrates the steps involved in method of operation of the instrument display cluster for effecting display of vehicle fault related information.

20 **[43]** The instrument display cluster **102** of the present fault diagnostic system **100** is configured to display said fault message only on receiving a predetermined

display command. The flowchart **300** in **FIG.4** shows the steps involved in providing said predetermined display command. For example, in a condition where the vehicle reaches a service station for servicing, and when the ignition switch is turned ON, the electronic control unit communicates via CAN communication vehicle fault related information to the instrument display cluster, if at all any fault is detected based on the steps described in **FIG.3**. Thus, on detection of a fault the electronic control unit sends a fault signal to the instrument display cluster and the second microcontroller in the instrument display cluster, on receiving said fault signal at block **301** causes the flash actuation of the fault display indicator provided therein at block **302**. Further, the second microcontroller checks for the predetermined display command. For example, in the present embodiment, said second microcontroller determines if a hazard switch of the vehicle is switched ON at block **303**. If the second microcontroller detects that hazard switch is ON, the electronic control unit further determines if a push button such as a boost button is long pressed for more than 10s at block **304**. Thus, the predetermined display command in accordance with the present invention involves selection of a hazard switch followed by long pressing a push button of the vehicle for a predetermined time interval. Therefore, on receiving the above described predetermined display command; the second microcontroller in the instrument display cluster causes the fault message to be displayed in a readable form at block **305**. The boost button as per the present invention serves as a means for starting the vehicle. Particularly, the boost button serves as a safety feature in the vehicle which aids in ensuring that the vehicle can be powered only after simultaneous selection of the boost button together with a brake lever.

[44] As per an aspect of the present invention, said fault message is presented in a readable format as shown in **FIGs.5a & FIG.5b**. Particularly, said instrument display cluster is configured to display the number of faults detected (A), short text (B) of faults detected, and a corresponding fault number (C) for each fault detected. For example, **FIG.5a** denotes the fault message "d tPS" for a condition in which either the throttle wire or the throttle position sensor becomes faulty. When such a condition is detected by said electronic control unit **101**, it disables

the vehicle. Particularly, such a fault condition corresponding to the above fault message may arise due to a fault in the throttle wire or in the throttle position sensor, which in turn could result in the throttle input being greater than 60% at the outset when only the ignition switch is turned ON. Initial throttle input itself
5 being very high could result in an accident when the vehicle operator unknowingly gives throttle, being unaware of the fault either in the throttle wire or in the throttle position sensor. Therefore, it becomes important to detect such a fault and deactivate the vehicle at the initial stages immediately after the ignition is switched on. On detection of the above condition, the electronic control unit
10 communicates via CAN communication to the instrument display cluster. The instrument display cluster in turn denotes a short text of the fault message "d tPS" on receiving the predetermined display command as discussed in the preceding paragraphs. A corresponding fault number 01 is also displayed next to the short text. The service attendant may easily identify the fault by mapping the fault
15 number and the short text with a look-up table in a service manual that may be provided in the service station. Thus, by merely referring to the service manual which contains a look-up table containing fault numbers with respective explanations of the fault that occurred in the vehicle, the service attendant may easily fix the faults in the vehicle and complete the servicing of the vehicle
20 quickly.

[45] FIG.5b denotes another example of a fault message that maybe displayed on the instrument display panel. "r yopen" refers to a condition where one of the phases is not connected to the electronic control unit. The above mentioned condition can arise due to any of the following conditions listed below, say for
25 example when either a phase wire connector has a loose contact, or motor phase coil has got burnt inside the motor or when a motor phase connector wire in a wiring harness gets burnt due to heat.

[46] In a condition, where multiple faults are detected by the electronic control unit, the instrument display cluster the number of faults along with the
30 short text and the fault number corresponding to each fault detected. Particularly in case multiple faults are detected, the number of faults, the short text and the

fault number for each fault is flashed one after the other with a short time interval between each flash.

[47] As per an aspect of the present invention, data relating to the vehicle fault related information is transferred by the electronic control unit to the instrument display cluster. For example, in an implementation, eight bytes (64 bits) of data may be transferred by the electronic control unit to said display cluster in one packet. In other words, at least **64** independent faults can be communicated by assigning each fault with one dedicated bit. Thus, the number of faults is identified by the second microcontroller by counting the number of "1"s in the 64 bit data and the number of faults is displayed. Depending on the complexity of the system and the number of faults, in another embodiment, the number of packets used may be increased. Further, the second microcontroller retrieves the corresponding short text and the corresponding fault codes from a reference table stored in the second microcontroller, and which in turn is prepared based on the bit number assigned to each fault.

[48] As is apparent from the above description, the fault diagnostic system serves to facilitate easy comprehension of the faults in the vehicle using the instrument display cluster as the fault diagnosis interface, and thereby serves as a cost effective means for fault identification in small vehicles such as two-wheeled electric/hybrid vehicles.

We claim:

1. A fault diagnostic system (100) for a vehicle (10), said vehicle having a plurality of power sources (14, 53), wherein said fault diagnostic system (100) comprises one or more vehicle switches including an ignition switch and a hazard switch, an instrument display cluster (102) operable to display one or more vehicle related information to a vehicle operator of the vehicle (10), said one or more vehicle related information includes vehicle fault related information, said instrument display cluster (102) having a plurality of display indicators, an electronic control unit (101) communicatively connected to the instrument display cluster (102), said electronic control unit (101) being adapted to process and transmit said one or more vehicle related information to the instrument display cluster (102) and one or more sensors (103a, 103b, 103c, 103d) operable to provide said one or more vehicle related information to the electronic control unit (101), wherein said instrument display cluster (102) is adapted to display said vehicle fault related information in the form of a fault message, and wherein said display of fault message triggered by a predetermined display command.
2. The fault diagnostic system (100) as claimed in claim 1, wherein said predetermined display command is given by a vehicle operator, wherein the vehicle fault related information is displayed in a format readable by the vehicle operator.
3. The fault diagnostic system (100) as claimed in claim 2, wherein the vehicle related information is displayed in a format readable by the vehicle operator by referring to a look-up table stored in one of the instrument display cluster and external service manual.
4. The fault diagnostic system (100) as claimed in claim 2, wherein the predetermined display command is issued by long pressing a vehicle push button for a time interval greater than a predetermined time interval.
5. The fault diagnostic system (100) as claimed in claim 4, wherein the predetermined time interval is 10 seconds.
6. The fault diagnostic system (100) as claimed in claim 4, wherein said vehicle push button includes a boost button capable of starting the vehicle (10).

7. The fault diagnostic system (**100**) as claimed in claim 2, wherein the predetermined display command is effected by switching on the hazard switch and long pressing a vehicle push button.
8. The fault diagnostic system (**100**) as claimed in claim 1, wherein the fault message includes number of faults detected, a short text corresponding to each fault detected and a corresponding fault number for each fault detected.
9. The fault diagnostic system (**100**) as claimed in claim 1, wherein the electronic control unit (**101**) is operable to change drive mode from an engaged drive mode of the vehicle in an event of the fault detected being a fault particular to the engaged drive mode.
10. The fault diagnostic system (**100**) as claimed in claim 9, wherein the instrument display cluster is configured to flash red to indicate the change in drive mode.
11. A control method for displaying one or more vehicle related information including vehicle fault related information on an instrument display cluster of a vehicle, wherein the control method comprises the steps of:
 - detecting and transmitting of vehicle related information by a one or more sensors (**103a**, **103b**, **103c**, **103d**) to an electronic control unit (**101**);
 - processing vehicle related information to identify vehicle fault related information by the electronic control unit (**101**);
 - communication of the said one or more vehicle related information by the electronic control unit (**101**) to an instrument display cluster (**102**);
 - displaying said one or more vehicle related information including said vehicle fault related information on the instrument display cluster (**102**),
 - displaying said vehicle fault related information as a fault message in said instrument display cluster (**102**), wherein said instrument display cluster (**102**) displays said fault message upon receiving of a predetermined display command.
12. The control method as claimed in claim 11, wherein the receiving of the predetermined display command is determined by checking whether a hazard switch

is ON, and in the event of the hazard switch being ON the instrument display cluster (102) checks for an event of a vehicle push button being long pressed for a predetermined time interval.

13. The control method as claimed in claim 12, wherein in the event of the vehicle push button being long pressed for said predetermined time interval the instrument display cluster (102) causes said fault message to be displayed on the instrument display cluster (102).
14. The control method as claimed in claim 11, wherein the electronic control unit (101) is operable to change drive mode from an engaged drive mode of the vehicle in an event of the fault detected being a fault particular to the engaged drive mode.
15. The control method as claimed in claim 14, wherein the instrument display cluster is configured to flash red to indicate the change in drive mode.
16. The control method as claimed in claim 11, wherein the electronic control unit (101) is powered by a battery (104), wherein the battery (104) is controlled by a battery management system comprising a controller capable of sending signals from the electronic control unit (101) and receiving signals from the electronic control unit (101).
17. The control method as claimed in claim 11, wherein the electronic control unit (101) comprises a first microcontroller operable to process said one or more vehicle related information, and wherein said one or more vehicle related information including the vehicle fault related information is communicated to the instrument display cluster (102) by a controlled area network, and wherein the instrument display cluster (102) comprises a second microcontroller adapted to convert the vehicle fault related information into the fault message.

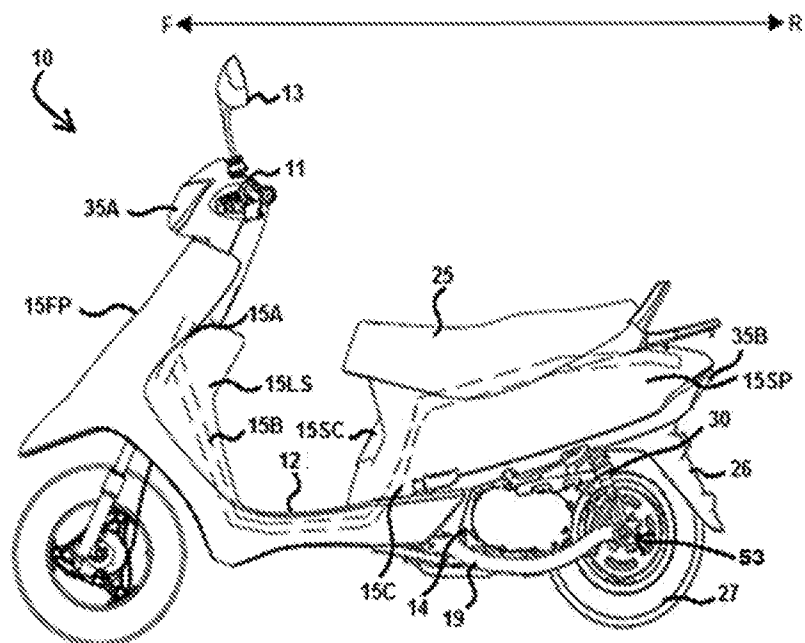


Fig.1

2/6

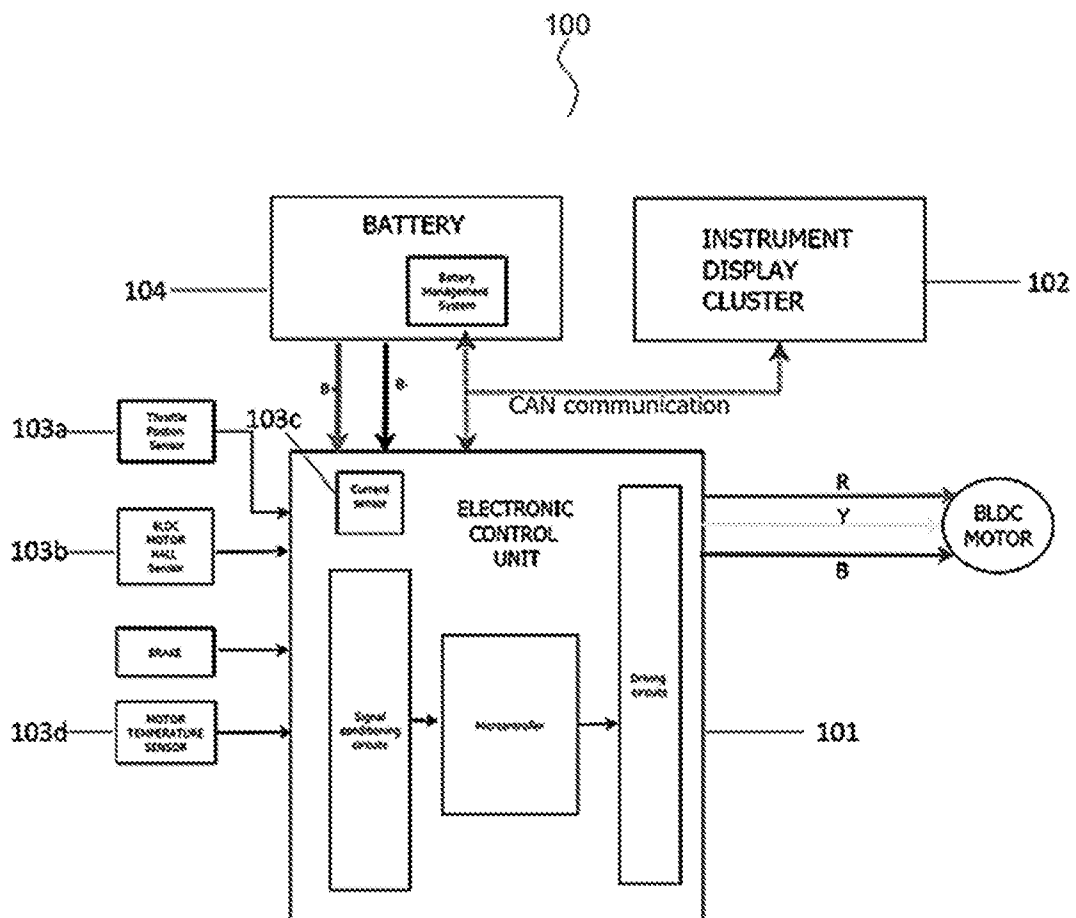


Fig.2

3/6

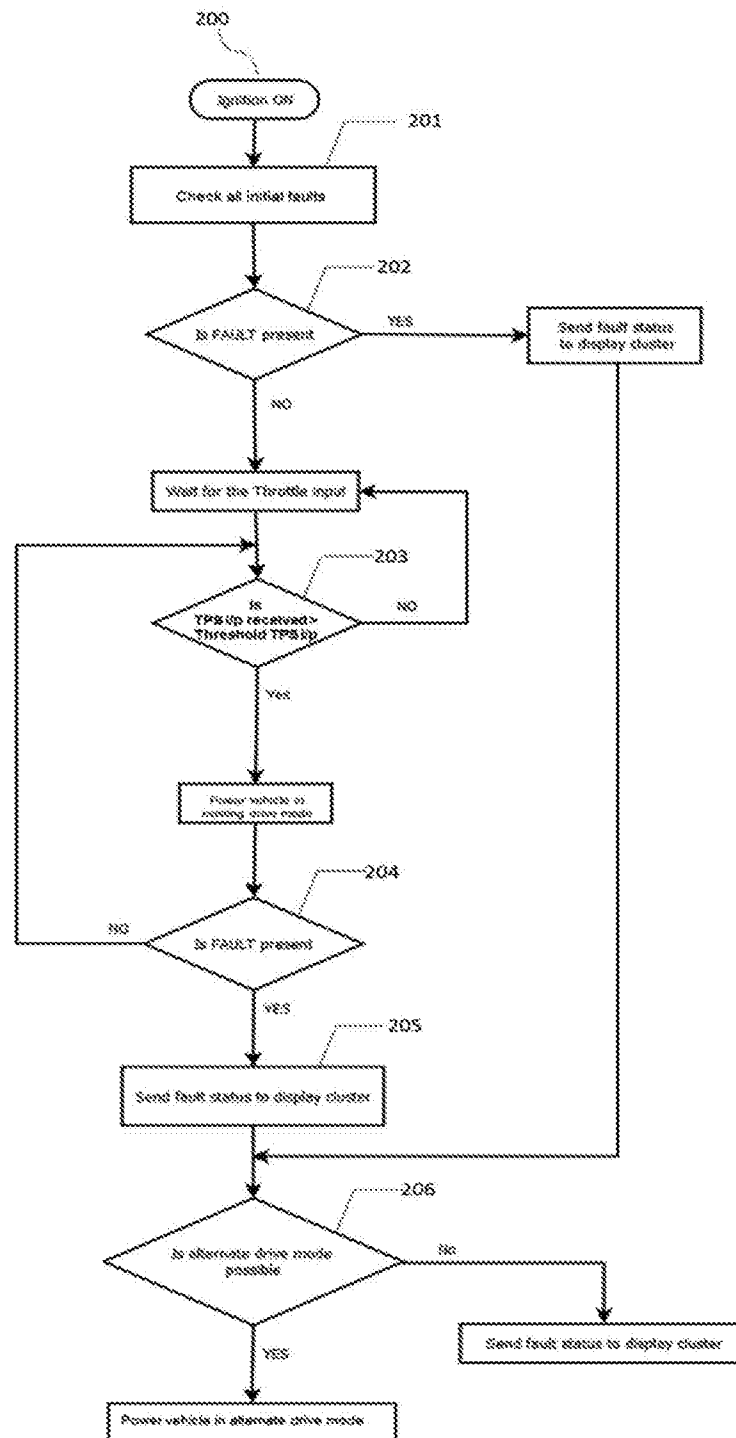


Fig.3

4/6

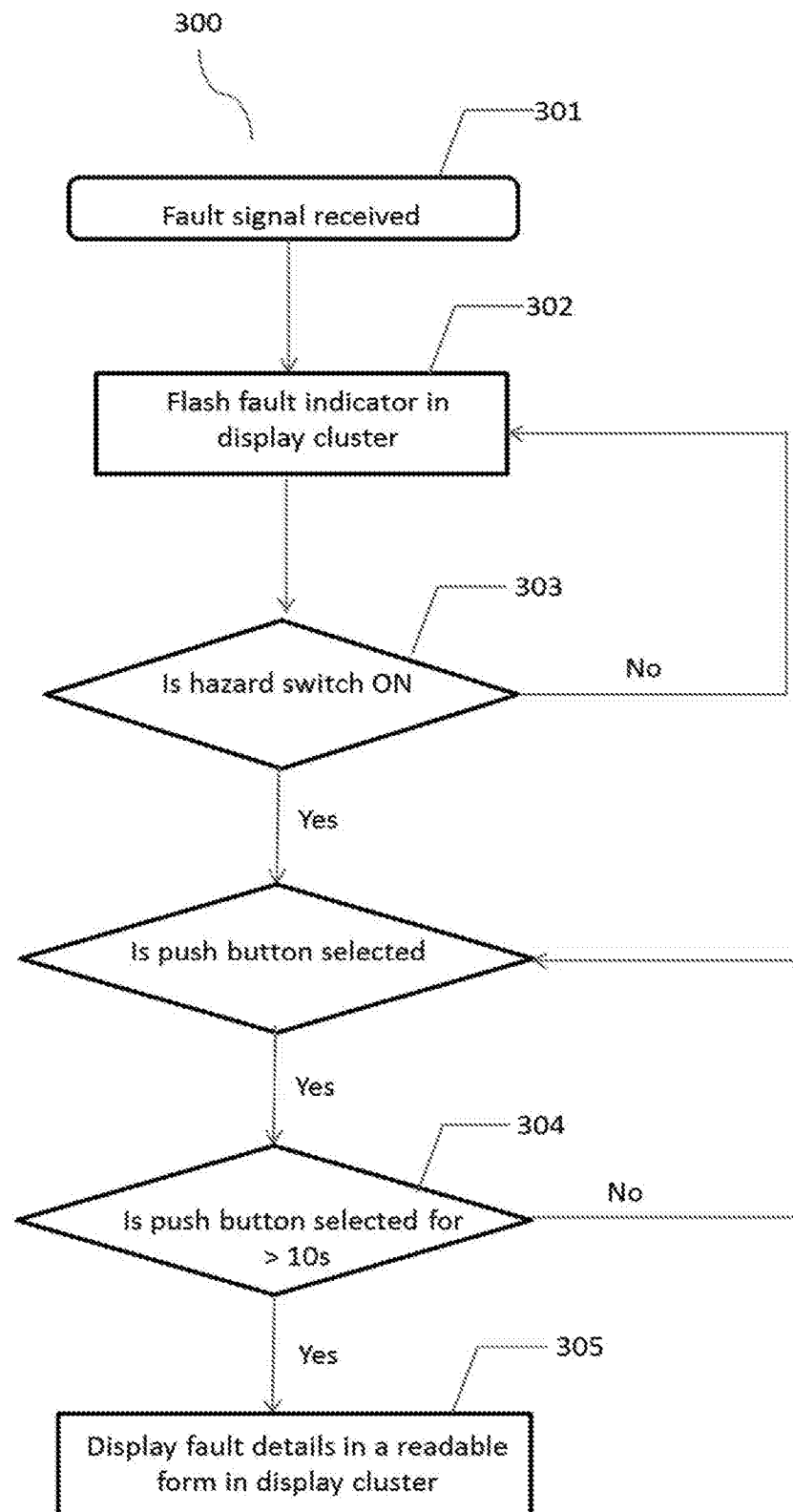


Fig.4

5/6

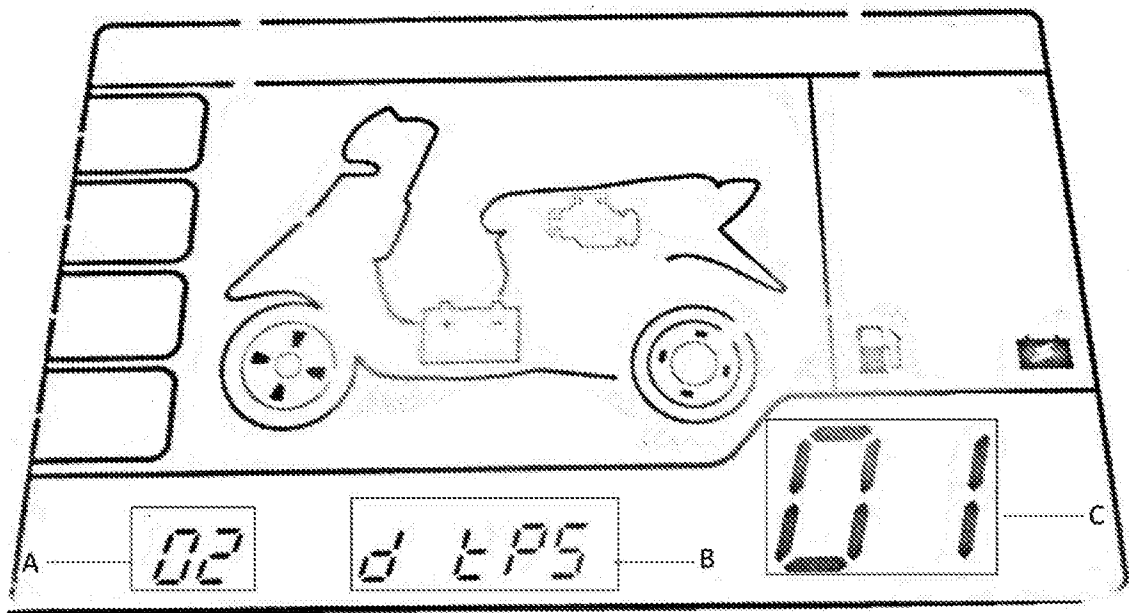


Fig. 5a

6/6

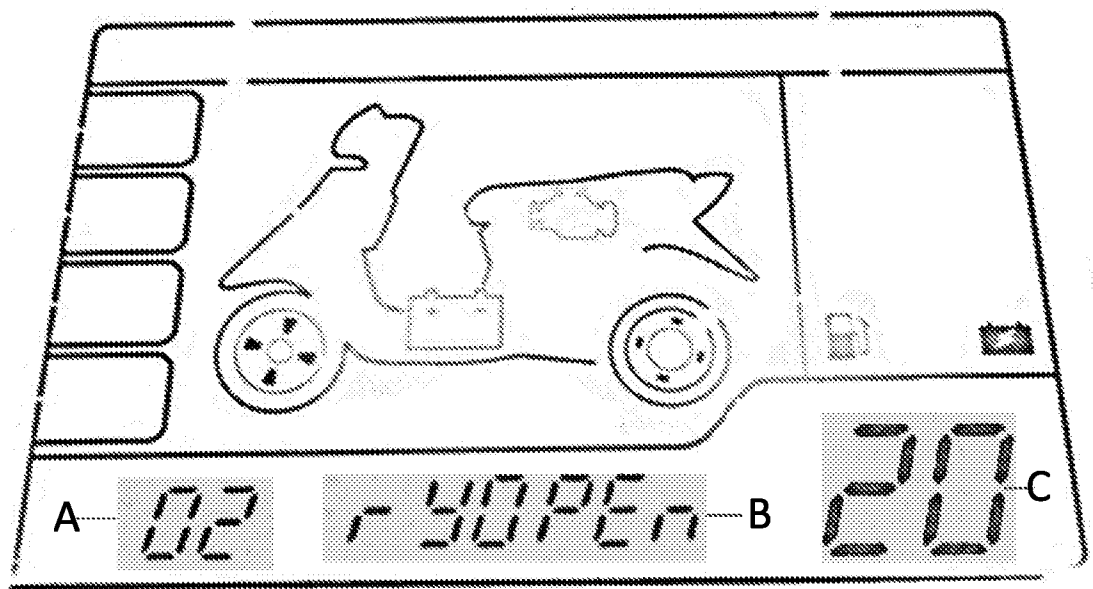


Fig.5b

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2017/057377

A. CLASSIFICATION OF SUBJECT MATTER
G05B19/406, G01R31/316, B60Q11/00 Version=2018.01

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)

G05B, G01R and B60Q

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

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

Patseer, IPO Internal Database

Keywords used:- diagnostic, hazard, switch, vehicle

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN101923348A (UNIV BEIJING TECHNOLOGY) 22.12.2010 (22 december, 2010) paragraphs [0002], [0004] and [0019]; claims 1 and 4 and abstract	1-17
Y	US5491631A (HONDA MOTOR CO LTD) 13.02.1996 (13 february, 1996) column 1, lines 32 to 44; column 3, lines 22 to 33 and column 5, lines 55 to 64; claims 1, 2 and 5; figures 2, 3 and 6 and abstract	1-17



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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Date of the actual completion of the international search

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