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(54) **A SYSTEM FOR TOGGLING BETWEEN RIDE MODES OF A VEHICLE AND METHOD THEREOF**

(57) The present invention is directed to a system (100) for toggling between ride modes of a vehicle. The system (100) includes: a start switch (110) to generate a ride mode selection signal; an RPM sensor (120) for measuring speed of an Internal Combustion (IC) engine (130); and a control unit (140) which is coupled with the start switch (110) and the RPM sensor (120). The control unit (140) is configured to: receive the ride mode selection

signal from the start switch (110); receive the speed of the engine from the RPM sensor (120); compare the speed of the engine with a predetermined speed of the engine; and control change in ride mode of the vehicle based on the ride mode selection signal if the speed of the engine is greater than the predetermined speed of the engine, thereby allowing the vehicle to toggle between ride modes.

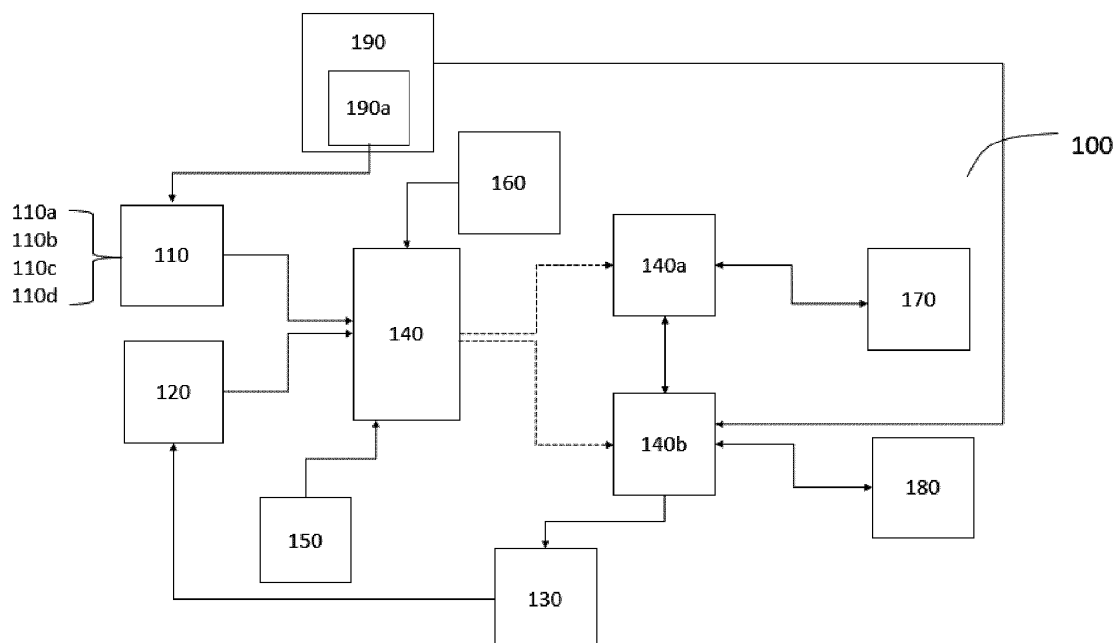


Figure 1

Description

FIELD OF THE INVENTION

[0001] The present invention relates to a system for toggling between ride modes of a vehicle and method thereof.

BACKGROUND OF THE INVENTION

[0002] Different riders have different expectations from a vehicle. It is almost impossible to make a vehicle which could meet the expectations of all the riders, both in terms of performance and fuel economy. Conventional vehicles offer only a single calibrated driving experience where the riders are not at liberty to adjust the vehicle riding experience as per their need.

[0003] To overcome this challenge, various driving or ride modes are provided nowadays in vehicles for selection by the rider. For this, various control systems are fitted in the vehicle. These control systems can change a state of the vehicle based on changing conditions around the vehicle, which are detected by various sensors. For example, the control system may vary a vehicle driving mode based on changing conditions and/or upon actuation by a rider. The effect of selecting a particular ride mode could be, for instance, change in torque and/or power produced by the engine.

[0004] In the existing vehicles, ride mode selection is carried out by means of a dedicated switch. Upon actuation of the dedicated switch by the rider, the engine performance is altered. The rider has the option to choose between several ride modes that are available in the vehicle, for example, fuel economy mode, street mode, and the likes. Installation of a dedicated switch for ride mode selection consumes ample space on the handlebar of the vehicle, which might affect the overall aesthetics of the vehicle. Moreover, the dedicated switch would require an additional circuit, thereby increasing the overall cost of the vehicle. Further, installation of the dedicated switch and its corresponding circuit will result in increased assembly time and require maintenance as well.

[0005] Apart from the problems associated with having the dedicated switch for ride mode selection, there are also shortcomings in the manner in which ride mode selection is made. For instance, some vehicle manufacturers require the vehicle to completely halt or decelerate to allow ride mode selection which is not desirable by most of the riders. Whereas others allow ride mode selection at higher vehicle speed, which is again not preferred considering the risks involved.

[0006] Thus, there is a need in the art for a system for toggling between ride modes of a vehicle and method thereof which addresses at least the aforementioned problems.

SUMMARY OF THE INVENTION

[0007] In one aspect, the present invention is directed to a system for toggling between ride modes of a vehicle.

The system includes a start switch configured to generate a ride mode selection signal, an RPM sensor for measuring speed of an Internal Combustion (IC) engine, and a control unit. The control unit is coupled with the start switch and the RPM sensor. The control unit is configured to: receive the ride mode selection signal from the start switch; receive the speed of the engine from the RPM sensor; compare the speed of the engine with a predetermined speed of the engine; and control change in ride mode of the vehicle based on the ride mode selection signal if the speed of the engine is greater than the predetermined speed of the engine, thereby allowing the vehicle to toggle between ride modes.

[0008] In an embodiment of the invention, the system also includes an ignition switch coupled with the control unit. The control unit is configured to receive a start signal from the ignition switch when in an ON state.

[0009] In another embodiment of the invention, the system further includes a speed sensor for measuring speed of the vehicle. The speed sensor is coupled with the control unit. The control unit is configured to control change in ride mode of the vehicle when the start switch is in a pressed condition for a predetermined time and the speed of the vehicle is less than a predetermined speed of the vehicle. In an embodiment of the invention, the predetermined time is 2 seconds, and the predetermined speed of the vehicle is 80 km/h. In another embodiment, the predetermined speed of the engine is 1200 RPM.

[0010] In yet another embodiment of the invention, the start switch is selected from an electric start switch, a headlamp switch, a TSL switch, and a hazard lamp switch.

[0011] In a further embodiment of the invention, the ride modes are selected from a race mode, a fuel economy mode, and a halt mode. The control unit is configured to stop the IC engine during the halt mode. In one embodiment, the start switch generates the ride mode selection signal for toggling to the halt mode when pressed for a first pre-set time, the first pre-set time being 4 seconds. In another embodiment, the start switch generates the ride mode selection signal for toggling to the race mode or the fuel economy mode when pressed more than once during a second pre-set time, the second pre-set time being 2 seconds.

[0012] In another embodiment of the invention, the control unit is configured to generate a display signal based on the ride mode selection signal. The display signal indicates a ride mode of the vehicle. The system also includes a speedometer controller coupled with a speedometer. The speedometer controller is configured to: receive the display signal; and display the ride mode of the vehicle on the speedometer.

[0013] In yet another embodiment of the invention, the system includes an Engine Control Unit (ECU) config-

ured to control operation of the IC engine based on the ride mode selection signal. The system further includes a starter relay having a starter coil coupled with the ECU and the start switch. The ECU is configured to apply a ground signal across the speedometer controller when the start switch is in pressed condition for the predetermined time and the speed of the engine is greater than the predetermined speed of the engine. The speedometer controller is configured to: sense the ground signal; and receive the display signal from the control unit.

[0014] In still further embodiment of the invention, the control unit is the ECU or the speedometer controller. In one embodiment, when the control unit is the speedometer controller, the speedometer controller is configured to sense the ground signal; generate a control signal based on the ride mode selection signal; and communicate the control signal to the ECU. The ECU is configured to control operation of the IC engine based on the control signal.

[0015] In yet another embodiment of the invention, the ECU is configured to: determine a malfunction condition in one or more components of the vehicle; and operate the IC engine in the fuel economy mode if the malfunction condition is determined.

[0016] In another aspect, the present invention is directed to a method for toggling between ride modes of a vehicle. The method includes the steps of: generating, by a start switch, a ride mode selection signal; receiving, by a control unit, the ride mode selection signal; and receiving, by the control unit, speed of an Internal Combustion (IC) engine from an RPM sensor. The method further includes the steps of comparing, by the control unit, the speed of the engine with a predetermined speed of the engine; and controlling change in ride mode of the vehicle, by the control unit, based on the ride mode selection signal if the speed of the engine is greater than the predetermined speed of the engine, thereby allowing the vehicle to toggle between ride modes. The predetermined speed of the engine is 1200 RPM.

[0017] In an embodiment of the invention, the method includes the step of receiving, by the control unit, a start signal from an ignition switch when in an ON state. The step of controlling change in ride mode of the vehicle is carried out when the start switch is in a pressed condition for a predetermined time and a speed of the vehicle from a speed sensor is less than a predetermined speed of the vehicle. The predetermined time is 2 seconds, and the predetermined speed of the vehicle is 80 km/h.

[0018] In another embodiment of the invention, the ride modes are selected from a race mode, a fuel economy mode, and a halt mode. In this regard, the method includes the step of stopping, by the control unit, the IC engine during the halt mode.

[0019] In still another embodiment of the invention, the method also includes the step of generating, by the control unit, a display signal based on the ride mode selection signal, the display signal indicates a ride mode of the vehicle. In this regard, the method includes the steps of:

receiving, by a speedometer controller, the display signal; and displaying, by the speedometer controller, the ride mode of the vehicle on a speedometer.

[0020] In yet another embodiment of the invention, the method further includes the step of controlling operation of the IC engine, by an Engine Control Unit (ECU), based on the ride mode selection signal. In this regard, the method includes the steps of: applying, by the ECU, a ground signal across the speedometer controller when the start switch is in the pressed condition for the predetermined time and the speed of the engine is greater than the predetermined speed of the engine; sensing, by the speedometer controller, the ground signal; and receiving, by the control unit, the display signal.

[0021] In a further embodiment of the invention, the control unit is the Engine Control Unit (ECU) or the speedometer controller. In this regard, the method includes the steps of: sensing, by the speedometer controller, the ground signal; generating, by the speedometer controller, a control signal based on the ride mode selection signal; communicating, by the speedometer controller, the control signal to the ECU; and controlling operation of the IC engine, by the ECU, based on the control signal.

[0022] In a still further embodiment of the invention, the method also includes the steps of: determining, by the ECU, a malfunction condition in one or more components of the vehicle; and operating the IC engine, by the ECU, in the fuel economy mode if the malfunction condition is determined.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] Reference will be made to embodiments of the invention, examples of which may be illustrated in accompanying figures. These figures are intended to be illustrative, not limiting. Although the invention is generally described in context of these embodiments, it should be understood that it is not intended to limit the scope of the invention to these particular embodiments.

Figure 1 illustrates a system for toggling between ride modes of a vehicle in accordance with an embodiment of the present invention.

Figure 2 illustrates the system of Figure 1 with a control unit being a speedometer controller in accordance with an embodiment of the present invention.

Figure 3 illustrates the system of Figure 1 with the control unit being an Engine Control Unit in accordance with an embodiment of the present invention.

Figure 4 illustrates a circuit with a ground signal across a speedometer in accordance with an embodiment of the present invention.

Figure 5 illustrates a method for toggling between the ride modes of the vehicle in accordance with an embodiment of the present invention.

Figure 6 and 6a show details of the steps illustrated in Figure 5 in accordance with an embodiment of the present invention.

Figures 7a and 8a show a display of street mode on the speedometer during day and night in accordance with an embodiment of the present invention.

Figures 7b and 8b show a display of race mode on the speedometer during day and night in accordance with an embodiment of the present invention.

Figures 9a and 10a show a display of street mode on the speedometer during day and night along with one or more parameters of the vehicle in accordance with an embodiment of the present invention.

Figures 9b and 10b show a display of race mode on the speedometer during day and night along with one or more parameters of the vehicle in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0024] Various features and embodiments of the present invention here will be discernible from the following further description thereof, set out hereunder. In the ensuing exemplary embodiments, the vehicle is a two wheeled vehicle. However, it is contemplated that the disclosure in the present invention may be applied to any automobile capable of accommodating the present subject matter without defeating the spirit of the present invention.

[0025] In one aspect, the present invention relates to a system for toggling between ride modes of a vehicle.

[0026] As shown in Figure 1, the system 100 includes a start switch 110 configured to generate a ride mode selection signal, and an RPM sensor 120 for measuring speed of an Internal Combustion (IC) engine 130.

[0027] In one embodiment, the start switch 110 is selected from an electric start switch 110a, a headlamp switch 110b, a TSL switch 110c, and a hazard lamp switch 110d. The start switch 110 is provided in the handle bar of the vehicle and accessible to the rider during the course of ride.

[0028] The system 100 also includes a control unit 140 coupled with the start switch 110 and the RPM sensor 120. The start switch 110 is configured to generate a ride mode selection signal while the RPM sensor 120 measures a speed of an Internal Combustion (IC) engine 130.

[0029] In an embodiment, the control unit 140 includes a speedometer controller 140a or an Engine Control Unit (ECU) 140b. Referring to Figure 1, the dotted line connection between the control unit 140 with the speedometer controller 140a and the ECU 140b represents that the control unit 140 is replaceable by either of the speedometer controller 140a or the ECU 140b. Said otherwise, there does not exist any communication as such between the control unit 140 and the speedometer controller 140a or the ECU 140b by means of hardwiring or controller area network (CAN), but instead the speedometer controller 140a or the ECU 140b is configured to perform the function of the control unit 140, as described herein. It is further to be understood that while the control unit 140 is replaceable with either of the speedometer controller

140a or the ECU 140b, the presence of both the speedometer controller 140a and the ECU 140b is preferred for the working of the system.

[0030] In an embodiment, as shown in Figure 2, the control unit 140 is the speedometer controller 140a. The speedometer controller 140a is coupled with the start switch 110, the RPM sensor 120, the ECU 140b and a speedometer 170. The speedometer controller 140a is configured to: receive a display signal; and display the ride mode of the vehicle on the speedometer 170.

[0031] In another embodiment, as shown in Figure 3, the control unit 140 is the ECU 140b. The ECU 140b is coupled with the start switch 110, the RPM sensor 120, and the speedometer controller 140a.

[0032] As shown in Figure 1, the control unit 140 is also coupled with an ignition switch 150, a speed sensor 160 for measuring speed of the vehicle V_s , the IC engine 130, and a starter relay 190. The ignition switch 150 is configured to generate a start signal when in an ON state. The starter relay 190 includes a starter coil 190a and a starter switch 190b (shown in Figure 3).

[0033] In an embodiment, as shown in Figures 2 and 3, the ECU 140b is coupled with the ignition switch 150, the speed sensor 160 and one or more components 180 of the vehicle.

[0034] The present invention allows toggling between ride modes of the vehicle when the ignition switch 150 is in the ON state. Said otherwise, a rider has to ensure that the ignition switch 150 is turned ON and certain conditions, as described hereinbelow, are satisfied for successfully selecting between different ride modes. In this regard, in an embodiment of the invention, the control unit 140 is configured to: receive the ride mode selection signal from the start switch 110, receive the speed of the engine RPM_s from the RPM sensor 120, and compare the speed of the engine RPM_s with a predetermined speed of the engine RPM_1 . The control unit 140 is also configured to control change in ride mode of the vehicle based on the ride mode selection signal if the speed of the engine RPM_s is greater than the predetermined speed of the engine RPM_1 , thereby allowing the vehicle to toggle between ride modes.

[0035] The start switch 110 performs a dual function of starting the vehicle as well as ride mode selection. The circuit shown in Figure 4 allows the start switch 110 to perform the dual function. As shown in Figure 4, the ignition switch 150 is connected between a power supply 145 and a brake switch 200. The brake switch 200 is coupled with the start switch 110. The start switch 110 is further coupled with the ECU 140b via the starter relay 190, particularly the starter coil 190a. For starting the vehicle, when the ignition switch is in ON state, the power supply 145 provides required voltage (for instance 12V) when the start switch 110 is actuated and the brake 200 is pressed by the rider. The starter coil 190a is energized after the ECU 140b provides a ground signal and the starter coil 190a closes the starter switch 190b, thereby completing the circuit for the IC engine 130 to be started

by the ECU 140b.

[0036] In an embodiment of the invention, as shown in Figure 4, the power supply 145 is also connected across the start switch 110 and the speedometer 170 such that when a ground signal is applied to the speedometer 170, the voltage from the power supply 145 appears across the speedometer 170. For ride mode selection, the ECU 140b is configured to supply a ground signal to the speedometer 170 when the start switch 110 is pressed for a predetermined time and the speed of the engine RPM_s is greater than the predetermined speed of the engine RPM_1 . Here again, the ECU 140b provides the ground signal to ensure that the required voltage is maintained across the speedometer 170, thereby allowing the speedometer 170 to provide the voltage further to the speedometer controller 140a to sense the ground signal and receive the display signal for ride mode toggling. The display signal is indicative of the ride mode of the vehicle.

[0037] In one embodiment, the ECU 140b is also configured to: determine a malfunction condition in the one or more components (180) of the vehicle; and operate the IC engine (130) in a fuel economy mode if the malfunction condition is determined.

[0038] In another embodiment, the ECU 140b is configured to control operation of the IC engine 130 based on the ride mode selection signal.

[0039] As described hereinbefore, the control unit 140 is configured to control change in ride mode of the vehicle based on the ride mode selection signal. In this regard, reference is now made to Figures 5, 6 and 6a which illustrate configuration of the system 100 and a method for toggling between ride modes of the vehicle. As shown in Figure 5, in step 401, the ride mode selection signal is generated by the start switch 110 when in pressed condition. The ride mode selection signal is generated when the rider actuates the start switch 110.

[0040] For generating the ride mode selection signal in step 401, the ignition switch 150 should be in the ON state. This is indicated by generating the start signal by the ignition switch 150 which is received by the control unit in step 400, as shown in Figure 6.

[0041] Thereafter, in step 402, the control unit 140 receives the ride mode selection signal. Meanwhile, the control unit 140 receives speed of the IC engine 130 from the RPM sensor, as shown in step 403.

[0042] Upon receiving the ride mode selection signal and the speed of the engine RPM_s , the control unit 140 compares the speed of the engine RPM_s with a predetermined speed of the engine RPM_1 in step 404. If the speed of the engine RPM_s is greater than the predetermined speed of the engine RPM_1 , the control unit 140 is configured to control the change in ride mode, thereby allowing the vehicle to toggle between ride modes. This is shown in step 405.

[0043] Alternately, as shown in step 406, if the speed of the engine RPM_s is less than the predetermined speed of the engine RPM_1 , the vehicle can be started. In one embodiment, the brake 200 is also required to be pressed

along with the start switch 110 for starting the vehicle.

[0044] In one embodiment, the predetermined speed of the engine RPM_1 is 1200 RPM.

[0045] Referring to Figure 6 which shows details of the method steps for toggling between ride modes in the vehicle in accordance with an embodiment of the invention. As shown in step 402, the start switch 110 is pressed for the predetermined time t1 for receiving the ride mode selection by the control unit 140. Further, in addition to receiving the speed of the engine RPM_s in step 403, the control unit 140 is also configured to receive the speed of the vehicle V_s from the speed sensor 160.

[0046] Thereafter, the control unit 140, in step 404, compares the speed of the vehicle V_s with a predetermined speed of the vehicle V_1 in addition to the speed of the engine RPM_s , as described hereinabove.

[0047] In step 405, the control unit 140 controls the change in ride mode when the speed of the engine RPM_s is greater than the predetermined speed of the engine RPM_1 , and the speed of the vehicle V_s is less than the predetermined speed of the vehicle V_1 .

[0048] In an embodiment, the predetermined time is 2 seconds, and the predetermined speed of the vehicle V_1 is 80 km/h. Thus, the present invention ensures safety of the rider while toggling between ride modes of the vehicle as ride mode selection is allowed at lower speeds only.

[0049] In an embodiment, the ride modes are selected from a race mode, a fuel economy mode, and a halt mode. Accordingly, as shown in step 415, the ECU 140b is configured to control the operation of IC engine in accordance with these ride modes. In particular, the IC engine 130 is calibrated to deliver a predetermined output when any of the ride modes is selected by the rider. For instance, when the ride mode is the fuel economy mode, the ECU 140b is configured to operate the IC engine 130 in a manner that results in higher fuel economy. However, the performance of the engine is limited. Similarly, when the ride mode is the race mode, ECU 140b is configured to operate the IC engine 130 in a manner that the engine performance is high, but fuel economy is low.

[0050] As shown in step 415a, the control unit 140 is configured to stop the IC engine 130 during the halt mode. For this, the start switch 110 generates the ride mode selection signal for toggling to the halt mode when pressed for a first pre-set time. In one embodiment, the first pre-set time is 4 seconds. Therefore, if the rider desires to stop the vehicle at any point of time, the start switch 110 is pressed for the first pre-set time. The ride mode selection signal corresponding to the start switch 110 being pressed for the first pre-set time indicates to the ECU 140b that the vehicle is to be stopped.

[0051] Similarly, for toggling to the race mode or the fuel economy mode, the start switch 110 generates the ride mode selection signal when pressed more than once during a second pre-set time. In one embodiment, the second pre-set time is 2 seconds. In an embodiment, the predetermined time and the second pre-set time is same.

[0052] In addition to pressing the start switch 110 for first pre-set time or second pre-set time or predetermined time, the ride mode selection can also be initiated upon frequently pressing the start switch 110. Said otherwise, if the start switch 110 is pressed once or twice or thrice (and so on), for the first pre-set time or the second pre-set time or the predetermined time, the present invention enables toggling between ride modes of the vehicle, as described herein.

[0053] In step 407, the ECU 140b applies the ground signal across the speedometer controller 140a when the start switch 110 is in the pressed condition for the predetermined time and the speed of the engine RPM_s is greater than the predetermined speed of the engine RPM_1 .

[0054] In step 408, the speedometer controller 140a senses the ground signal. Meanwhile, the control unit 140 generates the display signal based on the ride mode selection signal. This is shown in step 409. The display signal indicates the ride mode of the vehicle.

[0055] In step 410, the display signal is received by the speedometer controller 140a. The speedometer controller 140a displays the ride mode of the vehicle on the speedometer 170, as shown in step 411. The ride mode of the vehicle can be displayed on a display screen on the speedometer 170. Thus, the rider can easily view the ride mode selected by him/her.

[0056] In an embodiment, the speedometer is configured to display the ride modes on the display screen differently during day and night. In the present context, the fuel economy mode is also referred as street mode. Figures 7a and 7b show the display screen showing the street mode and the race mode respectively during the day. Similarly, Figures 8a and 8b show the display screen showing the street mode and race mode respectively during the night.

[0057] In another embodiment, the speedometer is also configured to display the ride modes on the display screen along with one or more parameters of the vehicle. In this regard, Figures 9a and 10a show the display screen showing the street mode during day and night, respectively. Additionally, the display screen also displays the one or more parameters such as an engine speed during the street mode. Similarly, Figures 9b and 10b show the display screen showing the race mode during day and night, respectively, with the engine speed being shown differently than in Figures 9a and 10a.

[0058] In step 412, the speedometer controller 140a generates a control signal based on the ride mode selection signal. The control signal is then communicated by the speedometer controller 140a to the ECU 140b, as shown in step 413.

[0059] Upon receiving the control signal, the ECU 140b controls the operation of the IC engine, as shown in step 415, particularly steps 415b and 415c. Said otherwise, the IC engine 130 delivers the output based on whether the selected ride mode is the fuel economy or the race mode.

[0060] In one embodiment, the ride mode of the vehicle when the vehicle is started is the fuel economy mode. This is the default ride mode of the vehicle. Therefore, if the rider desires to toggle from the fuel economy mode to the race mode, the method steps of the present invention need to be performed. Similarly, if the vehicle is already in the race mode, the rider can toggle to fuel economy mode by performing the method steps of the present invention.

[0061] In another embodiment, as shown in step 414, the ECU 140b is also configured to determine a malfunction condition in one or more components 180 of the vehicle. In case, the malfunction condition is determined, the ECU 140b ensures that the rider is unable to toggle from the fuel economy mode. Said otherwise, the ECU 140b will allow operation of the IC engine 130 in the fuel economy mode only. This is shown in step 415c. This feature ensures that the emission levels are not beyond a certain threshold in case any of the critical components of the vehicle are damaged or malfunctioning.

[0062] Advantageously, the present invention overcomes the requirement of a dedicated switch and a corresponding circuit for toggling between ride modes of the vehicle. As described hereinabove, the existing start switch 110 can be utilized for toggling between ride modes. This results in saving the cost of installing and maintaining the dedicated switch as well as retains the aesthetics of the vehicle.

[0063] Further, since the components of the system 100, such as the speedometer controller 140a, the ECU 140b and the start switch 110 already exist in all the vehicles and can be effectively used to toggle between ride modes, the reliability is increased, and cost for additional component is omitted. This also results in reduced assembly time.

[0064] Moreover, the present invention ensures rider safety and comfort as it allows toggling ride modes in certain conditions only without removing hands-off from the handle bar during riding. Furthermore, the ride mode selection using the present invention is smooth and without any jerk or inconvenience to the rider.

[0065] While the present invention has been described with respect to certain embodiments, it will be apparent to those skilled in the art that various changes and modification may be made without departing from the scope of the invention as defined in the following claims.

Claims

1. A system (100) for toggling between ride modes of a vehicle comprising:

a start switch (110) configured to generate a ride mode selection signal;
an RPM sensor (120) for measuring speed of an Internal Combustion (IC) engine (130);
a control unit (140) coupled with the start switch

(110) and the RPM sensor (120); the control unit (140) configured to:

- receive the ride mode selection signal from the start switch (110);
 receive the speed of the engine (RPM_s) from the RPM sensor (120);
 compare the speed of the engine (RPM_s) with a predetermined speed of the engine (RPM_1); and
 control change in ride mode of the vehicle based on the ride mode selection signal if the speed of the engine (RPM_s) is greater than the predetermined speed of the engine (RPM_1), thereby allowing the vehicle to toggle between ride modes.
2. The system (100) as claimed in claim 1, comprising an ignition switch (150) coupled with the control unit (140), the control unit (140) configured to receive a start signal from the ignition switch (150) when in an ON state.
 3. The system (100) as claimed in claim 1 or 2, comprising a speed sensor (160) for measuring speed of the vehicle (V_s), the speed sensor (160) coupled with the control unit (140), wherein the control unit (140) is configured to control change in ride mode of the vehicle when the start switch (110) is in a pressed condition for a predetermined time and the speed of the vehicle (V_s) is less than a predetermined speed of the vehicle (V_1).
 4. The system (100) as claimed in any one of the preceding claims, wherein the start switch (110) is selected from an electric start switch (110a), a headlamp switch (110b), a TSL switch (110c), and a hazard lamp switch (110d).
 5. The system (100) as claimed in any one of the preceding claims, wherein the ride modes are selected from a race mode, a fuel economy mode, and a halt mode.
 6. The system (100) as claimed in claim 5, wherein the start switch (110) generates the ride mode selection signal for toggling to the halt mode when pressed for a first pre-set time, the first pre-set time is 4 seconds.
 7. The system (100) as claimed in claim 5 or 6, wherein the start switch (110) generates the ride mode selection signal for toggling to the race mode or the fuel economy mode when pressed more than once during a second pre-set time, the second pre-set time is 2 seconds.
 8. The system (100) as claimed in any one of the preceding claims, wherein the control unit (140) is configured to generate a display signal based on the ride mode selection signal, the display signal indicates a ride mode of the vehicle, and wherein a speedometer controller (140a) coupled with a speedometer (170), the speedometer controller (140a) configured to: receive the display signal; and display the ride mode of the vehicle on the speedometer (170).
 9. The system (100) as claimed in any one of the preceding claims, comprising an Engine Control Unit (ECU) (140b) configured to control operation of the IC engine (130) based on the ride mode selection signal.
 10. The system (100) as claimed in claim 9, comprising a starter relay (190) having a starter coil (190a) coupled with the ECU (140b) and the start switch (110), wherein the ECU (140b) is configured to apply a ground signal across the speedometer controller (140a) when the start switch (110) is in pressed condition for the predetermined time and the speed of the engine (RPM_s) is greater than the predetermined speed of the engine (RPM_1); and the speedometer controller (140a) is configured to: sense the ground signal; and receive the display signal from the control unit (140).
 11. The system (100) as claimed in claim 9 or 10, wherein when the control unit (140) is the speedometer controller (140a), the speedometer controller (140a) is configured to sense the ground signal; generate a control signal based on the ride mode selection signal; and communicate the control signal to the ECU (140b), the ECU (140b) controls operation of the IC engine (130) based on the control signal.
 12. The system (100) as claimed in claims 5 and 9, 10 or 11, wherein the ECU (140b) is configured to: determine a malfunction condition in one or more components (180) of the vehicle; and operate the IC engine (130) in the fuel economy mode if the malfunction condition is determined.
 13. A method for toggling between ride modes of a vehicle comprising the steps of:
 generating (401), by a start switch (110), a ride mode selection signal;
 receiving (402), by a control unit (140), the ride mode selection signal;
 receiving (403), by the control unit (140), speed of an Internal Combustion (IC) engine (130) from an RPM sensor (120);
 comparing (404), by the control unit (140), the speed of the engine (RPM_s) with a predetermined speed of the engine (RPM_1); and
 controlling (405) change in ride mode of the ve-

hicle, by the control unit (140), based on the ride mode selection signal if the speed of the engine (RPM_s) is greater than the predetermined speed of the engine (RPM_1), thereby allowing the vehicle to toggle between ride modes.

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14. The method as claimed in claim 13, wherein the step of controlling change in ride mode of the vehicle, by the control unit (140), is carried out when the start switch (110) is in a pressed condition for a predetermined time and a speed of the vehicle (V_s) from a speed sensor (160) is less than a predetermined speed of the vehicle (V_i), wherein the predetermined time is 2 seconds, and the predetermined speed of the vehicle (V_i) is 80 km/h.
15. The method as claimed in claim 13 or 14, comprising the step of stopping (415a), by the control unit (140), the IC engine (130) during the halt mode.

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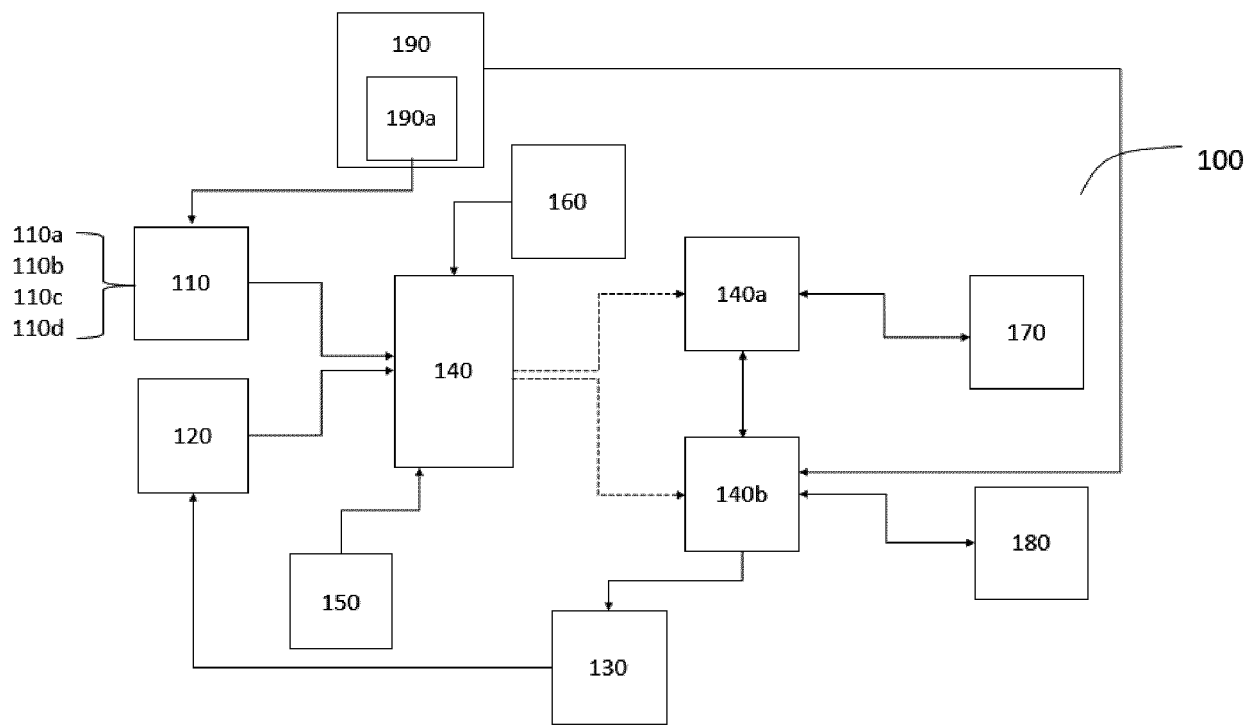


Figure 1

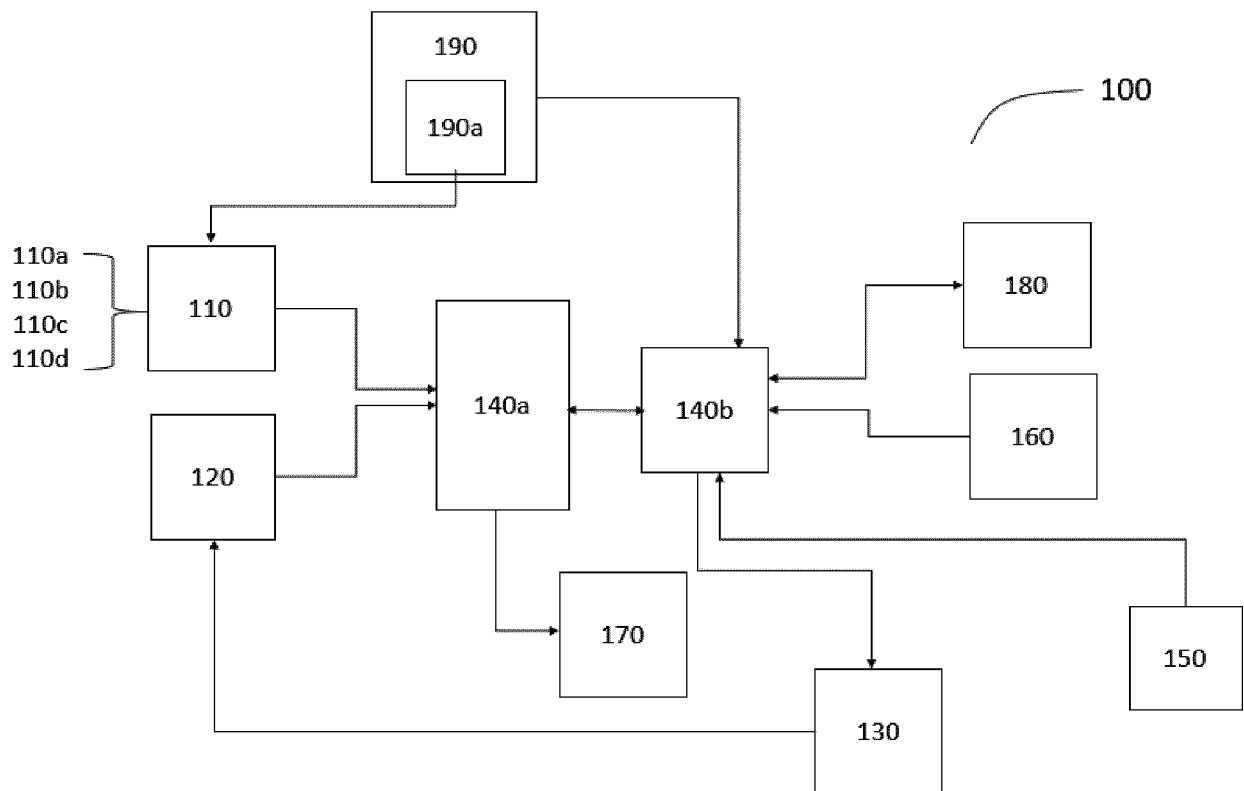


Figure 2

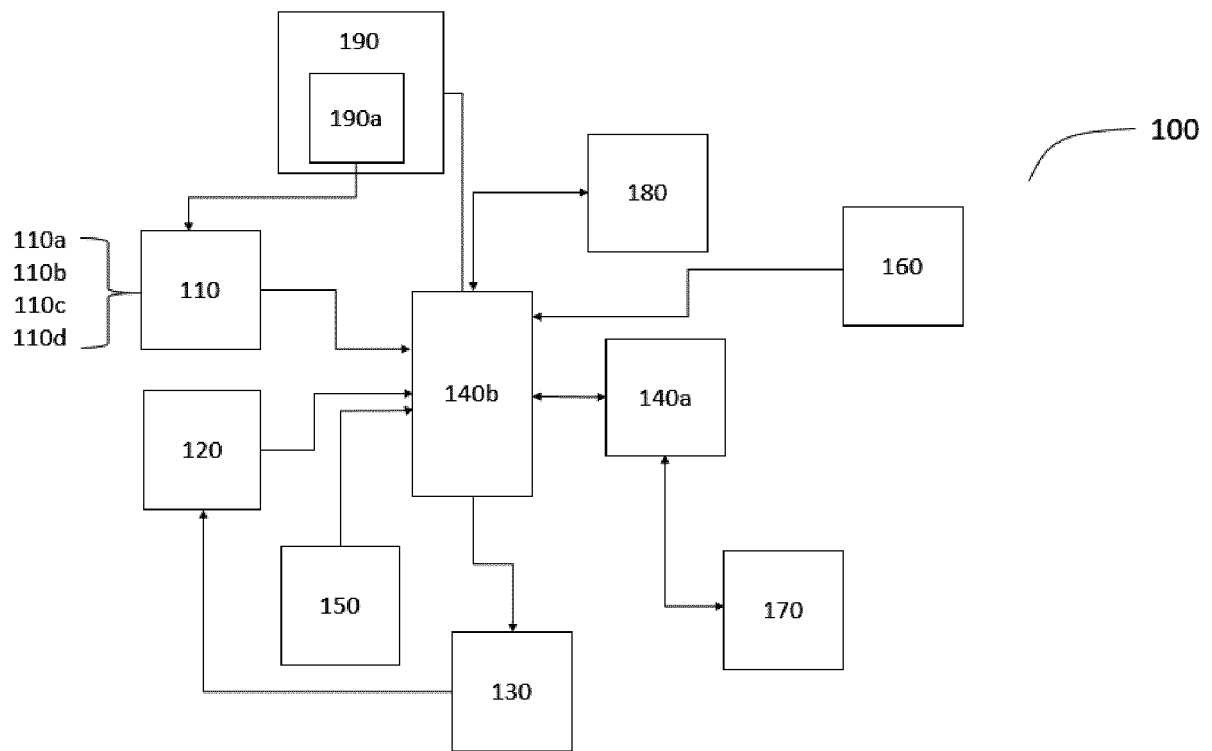


Figure 3

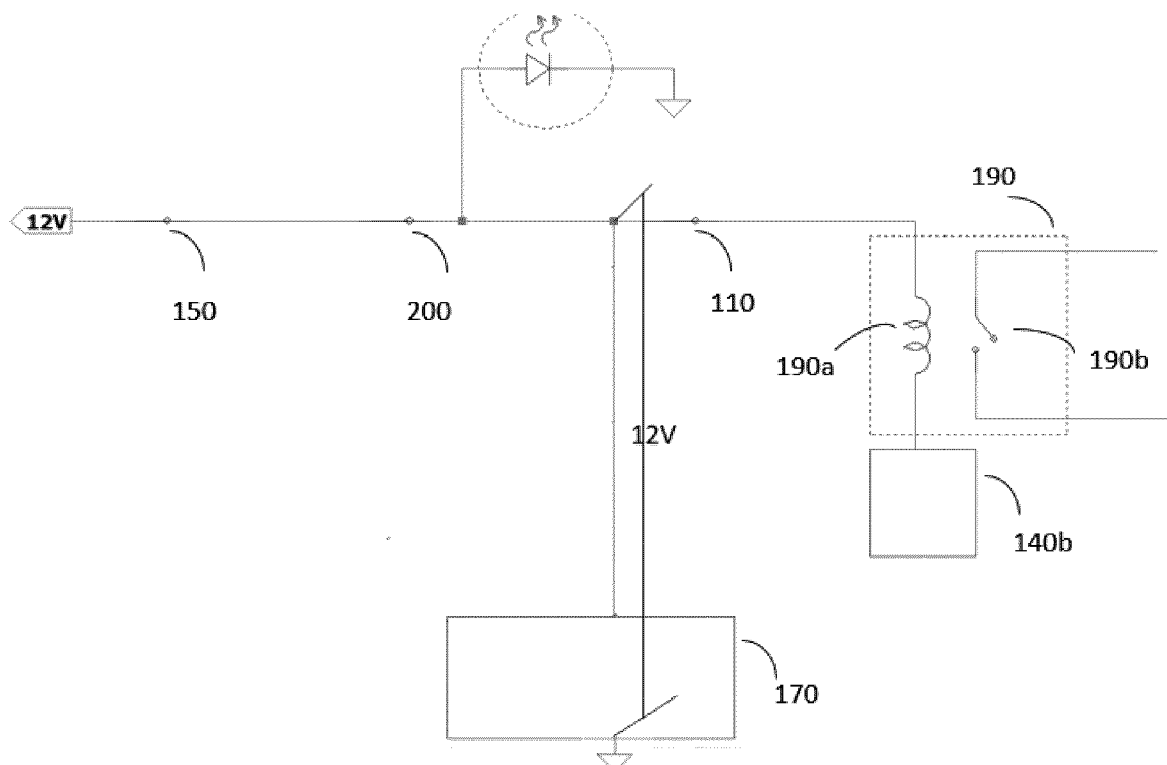


Figure 4

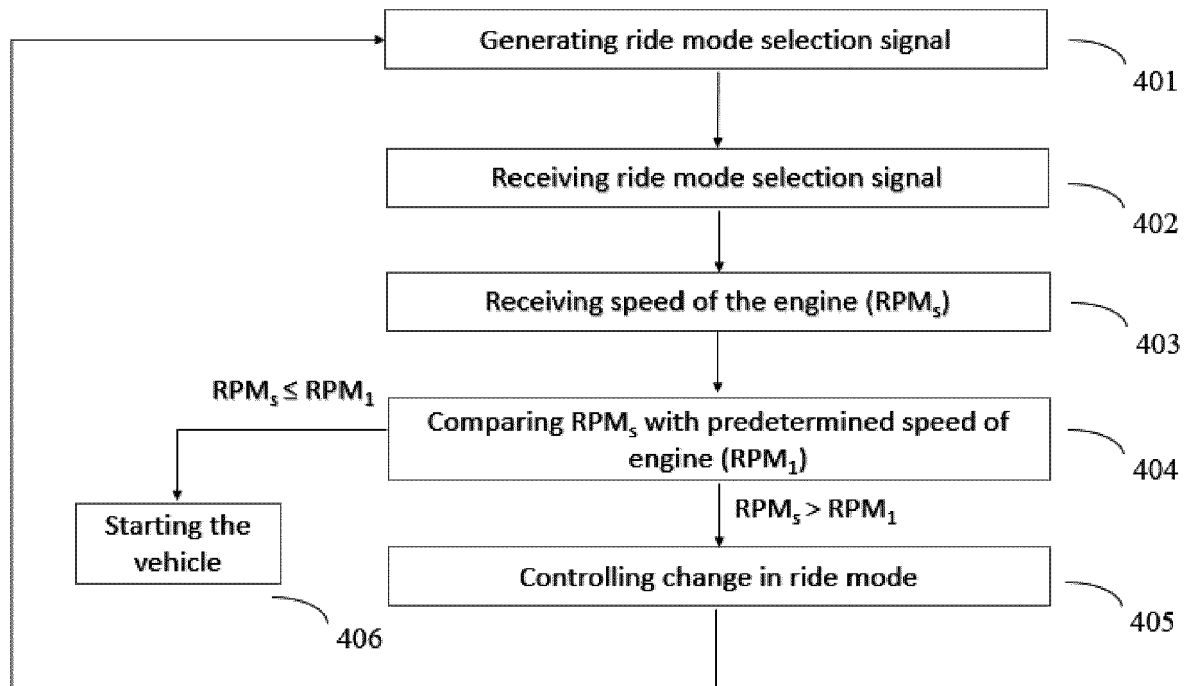


Figure 5

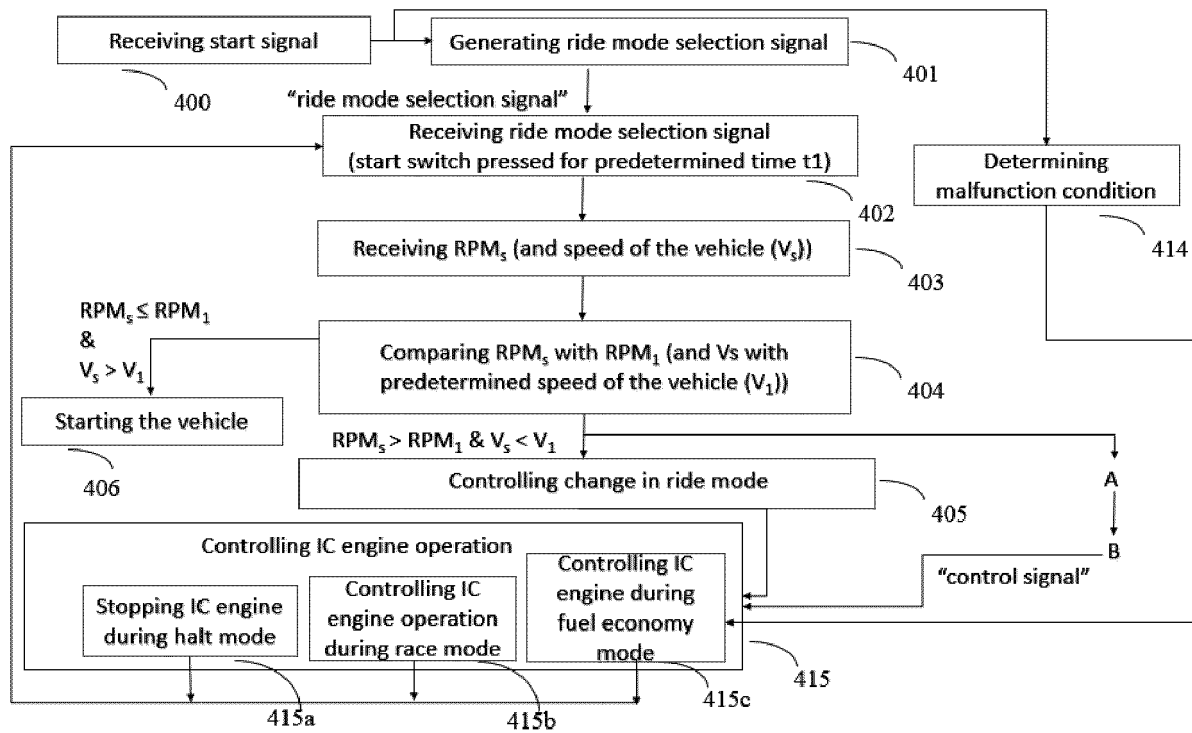


Figure 6

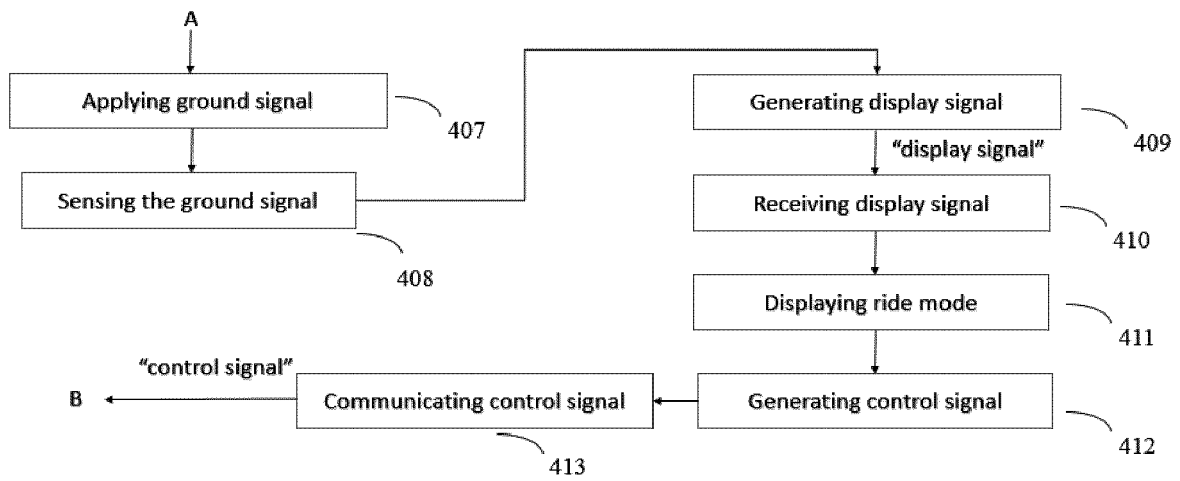


Figure 6a



Figure 7a



Figure 7b



Figure 8a



Figure 8b

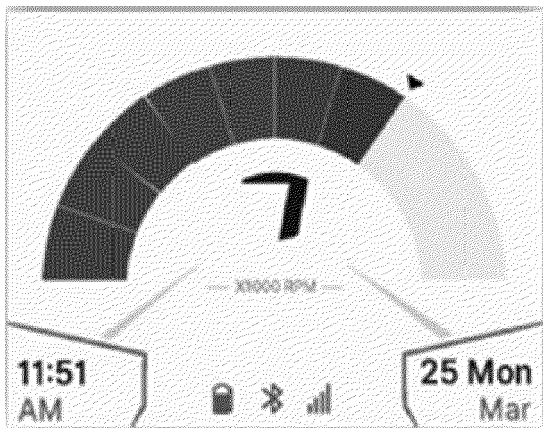


Figure 9a

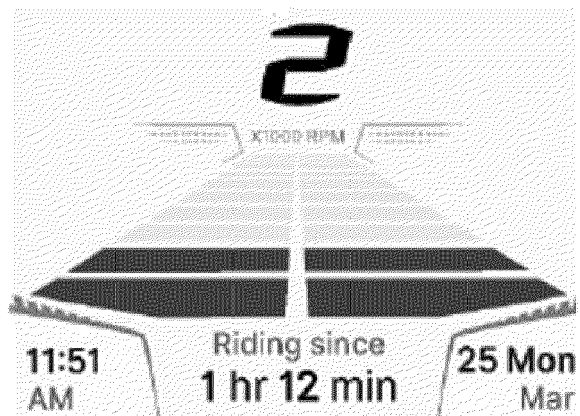


Figure 9b

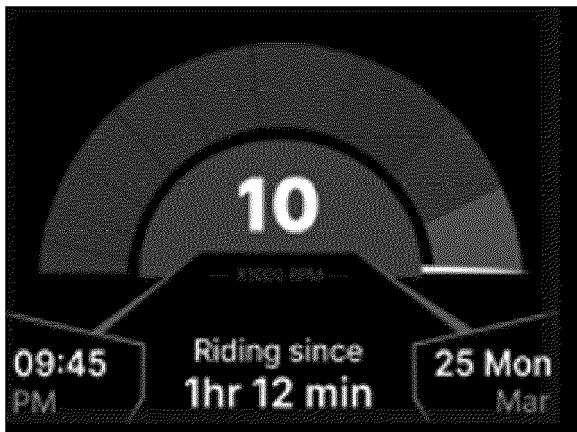


Figure 10a

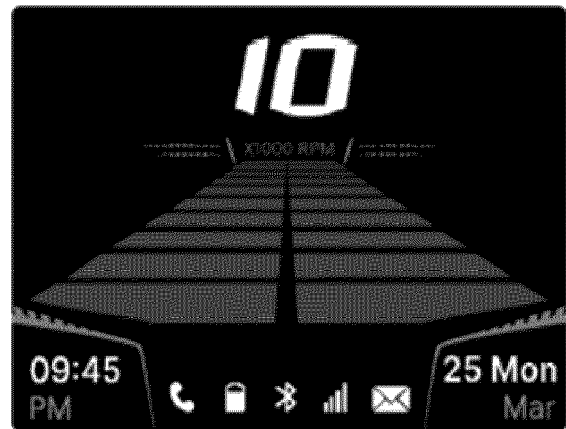


Figure 10b



EUROPEAN SEARCH REPORT

Application Number

EP 22 16 3507

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EPO FORM 1503 03.82 (P04C01)

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 9 541 020 B2 (SUZUKI MOTOR CORP [JP]) 10 January 2017 (2017-01-10)	1, 4, 5, 7-11, 13, 15	INV. F02N11/08 F02D41/28
Y	* column 4, line 13 - column 9, line 4; figures 1-4, 6 *	2, 3, 6, 12, 14	
Y	----- EP 1 882 607 B1 (YAMAHA MOTOR CO LTD [JP]) 11 January 2012 (2012-01-11) * paragraph [0086]; figures 1, 3 *	2	
Y	----- EP 2 299 095 A2 (KAWASAKI HEAVY IND LTD [JP]) 23 March 2011 (2011-03-23) * paragraphs [0037] - [0050]; figures 1, 3, 4 *	3, 6, 12, 14	
A	----- US 8 516 992 B2 (AKATSUKA HIDENORI [JP]; YAMAHA MOTOR CO LTD [JP]) 27 August 2013 (2013-08-27) * column 5, line 29 - column 8, line 67; figures 1-4, 6, 10 * * column 11, line 57 - column 12, line 15 *	1-15	
	-----		TECHNICAL FIELDS SEARCHED (IPC)
			F02D F02N
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 17 August 2022	Examiner Deseau, Richard
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 22 16 3507

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 9541020	B2	10-01-2017	DE 112015002253 T5
			02-03-2017
			JP 6340903 B2
			13-06-2018
			JP 2015214959 A
			03-12-2015
			US 2016153379 A1
			02-06-2016
			WO 2015174274 A1
			19-11-2015
EP 1882607	B1	11-01-2012	AT 540834 T
			15-01-2012
			EP 1882607 A2
			30-01-2008
			ES 2377663 T3
			29-03-2012
			TW 200829461 A
			16-07-2008
EP 2299095	A2	23-03-2011	EP 2299095 A2
			23-03-2011
			JP 5386273 B2
			15-01-2014
			JP 2011043141 A
			03-03-2011
US 8516992	B2	27-08-2013	AT 511005 T
			15-06-2011
			EP 2161433 A2
			10-03-2010
			ES 2366823 T3
			25-10-2011
			JP 2010084757 A
			15-04-2010
			US 2010059018 A1
			11-03-2010