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(54) VEHICLE SETTING APPARATUS AND METHOD

(57) An apparatus 100 for maintaining driver-selected settings in a vehicle takes the form of an electronic circuit module, which connects to a vehicle's management system via an I2C interface in which the vehicle is the master and the module is the slave. The module advantageously replaces an original equipment manufacture (OEM) circuit module. At the heart of the apparatus is a microcontroller 120 for controlling the operation of the apparatus. The microcontroller 120 connects electronically to the I2C interface (not shown) of the vehicle via a connector 140. The apparatus derives power from the vehicle via a voltage regulator 160 and analogue to digital signals are received via a voltage divider 180. Function buttons of the vehicle are connected to the controller and are represented at 200. Backlight diodes 220 and function state diodes 240 are also connected to the controller 120. A non-volatile memory 260 is built into the microcontroller 120.

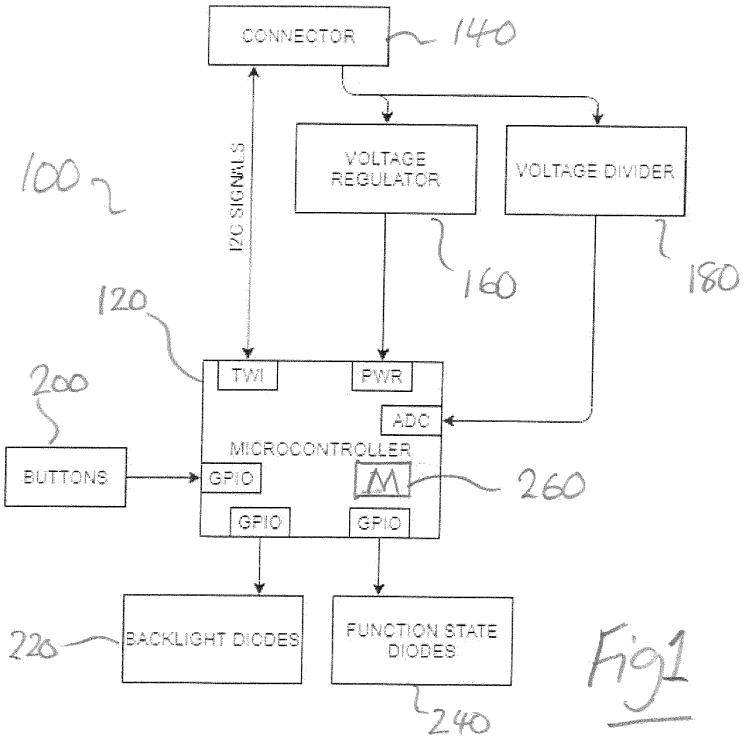

Fig1

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Description

[0001] The present invention relates to an apparatus and method for saving driver-selected settings in a vehicle.

[0002] Most modern automobiles provide the driver with a range of configurable vehicle settings that enable the driver to determine how the vehicle will perform in certain respects. Examples of these include throttle response, gear-change points, and apparent steering weight, among others. The driver is able to change these from the factory settings by pressing one or more buttons. However, once the ignition is turned off, the selections are lost and the settings are reset to those originally configured by the factory.

[0003] Embodiments of the present invention aim to provide a simple apparatus and method that allows the driver's chosen settings to be restored after an ignition cycle is performed.

[0004] The present invention is defined in the attached independent claims, to which reference should now be made. Further, preferred features may be found in the sub-claims appended thereto.

[0005] According to one aspect of the present invention, there is provided apparatus for maintaining driver-selected settings in a vehicle, the apparatus comprising a controller for controlling the operation of the apparatus, a memory device for storing driver-selectable vehicle settings data, a connector for connecting the apparatus to a vehicle and at least one status sensor for detecting a status or value of at least one driver-selectable vehicle setting, wherein the apparatus is arranged in use to be connected to a vehicle and to detect and store driver-selectable settings of the vehicle, so that driver preferences for settings are preserved after operation of the vehicle is ended by turning off the ignition.

[0006] The memory device is preferably a non-volatile memory, such as an EEPROM, and may be located within a common integrated circuit device with the microcontroller.

[0007] Preferably the apparatus includes an engine-start sensor arranged in use to detect an engine-start event.

[0008] The engine-start sensor is preferably arranged in use to monitor an input voltage to the apparatus and to detect a drop in said voltage that meets predetermined conditions. The engine-start sensor is preferably arranged in use to detect a drop in the input voltage below a first predetermined threshold value. The engine-start sensor is preferably arranged in use to detect a return in input voltage to a level above a second predetermined threshold value.

[0009] The one or more status sensor is preferably arranged in use to detect a setting actuator status, more preferably a condition, value, position or configuration of a setting actuator. The setting actuator may comprise a button. The one or more status sensor is preferably arranged to detect the pressing or latching of the actuator or button in an "ON" position. In a preferred arrangement, the apparatus detects the status of a setting actuator by detecting the status (ie ON or OFF) of an indicator, more preferably a visual indicator, such as an LED, associated with the actuator.

[0010] The apparatus is preferably arranged in use to register the status of one or more settings actuators and to store this in the memory. After an engine start event has been determined, the apparatus is preferably arranged to simulate the stored status of the or each settings actuator. In this way, the previously stored settings are represented to the vehicle management system without requiring action by the driver.

[0011] The apparatus preferably comprises a replacement circuit module arranged in use to take the place of an original equipment manufacturer (OEM) circuit module.

[0012] According to another aspect of the present invention, there is provided a method of maintaining driver-selected settings in a vehicle, the method comprising detecting a status or value of at least one driver-selectable vehicle setting and storing the driver-selectable vehicle setting in a memory so that driver preferences for settings are preserved after operation of the vehicle is ended by turning off the ignition.

[0013] Preferably the method includes detecting an engine-start event. The method may include detecting an engine-start event by monitoring an input voltage and detecting a drop in said voltage that meets one or more predetermined conditions. Preferably the method includes detecting a drop in the input voltage below a first predetermined threshold value. The method may include detecting a return in input voltage to a level above a second predetermined threshold value.

[0014] The method may include detecting a setting actuator status, more preferably detecting a condition, value, position or configuration of a setting actuator, which may comprise a button. Preferably the method includes detecting the pressing or latching of the actuator or button in an "ON" position.

[0015] The method preferably includes registering the status of one or more settings actuators and storing this in a memory. After an engine start event has been determined, the method preferably includes simulating the stored status of the or each settings actuator.

[0016] In a further aspect, the invention provides a computer programme product on a computer readable medium, comprising instructions that, when executed by a computer, cause the computer to perform a method of maintaining driver-selected settings in a vehicle in accordance with any statement herein.

[0017] The invention also comprises a program for causing a device to perform a method according to any statement herein.

[0018] The invention may include any combination of the features or limitations referred to herein, except such a combination of features as are mutually exclusive, or mutually inconsistent.

[0019] A preferred embodiment of the present invention will now be described, by way of example only, with reference to the accompanying diagrammatic drawings, in which:

Figure 1 shows schematically an apparatus for maintaining vehicle settings, according to an embodiment of the present invention;

Figure 2 is a schematic flow diagram illustrating a main programme flow of a method of controlling vehicle settings in accordance with the embodiment of Figure 1;

Figures 3 and 4 are schematic flow diagrams of interrupt service routines independent of the main programme flow shown in Figure 2; and

Figure 5 is a schematic flow diagram of a sub routine of the main programme flow of Figure 2.

[0020] In accordance with a preferred embodiment of the present invention, an apparatus for maintaining driver-selected settings in a vehicle takes the form of an electronic circuit module, which connects to a vehicle's management system via an I2C interface in which the vehicle is the master and the module is the slave. The module advantageously replaces an original equipment manufacture (OEM) circuit module.

[0021] Turning to Figure 1, this shows generally at 100 an apparatus module for maintaining driver-selectable settings in a vehicle, in accordance with an embodiment of the present invention. The apparatus may be configured as one or more circuit boards or else as a plug-in module for the vehicle (not shown). At the heart of the apparatus is a microcontroller 120 for controlling the operation of the apparatus. The microcontroller 120 connects electronically to the I2C interface (not shown) of the vehicle via a connector 140. The apparatus derives power from the vehicle via a voltage regulator 160 and analogue to digital signals are received via a voltage divider 180.

[0022] Function buttons of the vehicle are connected to the controller and are represented at 200. Backlight diodes 220 and function state diodes 240 are also connected to the controller 120. A non-volatile memory 260 is built into the microcontroller 120.

[0023] The operation of the apparatus 100 will now be described with reference to a main programme flow diagram shown generally at 1000 in Figure 2 along with a WRITE COMMAND (interrupt) flow diagram shown generally at 2000 in Figure 3, a READ COMMAND (interrupt) flow diagram shown generally at 3000 in Figure 4 and an ENGINE STARTED (subroutine) flow diagram shown generally at 4000 in Figure 5.

[0024] When the apparatus 100 is powered up at Step 1010, the state of desired functions is retrieved from the non-volatile memory 260 at Step 1020. For example, the state of the selectable function START STOP: (ON/OFF) is retrieved from the memory. At Step 1030 the voltage supply to the module is checked. If an ENGINE STARTED condition is detected, the process goes to the ENGINE STARTED subroutine 5000, as shown in Figure 5, before returning at a Step 1040. If not, the controller checks at Step 1040 whether a BUTTON PRESSED flag has been set, indicating that the state of one of the function buttons supported by the system has been changed since the last check. If the flag has been set, the status of the button function is saved to the memory at Step 1050. Then the flag is cleared at Step 1060. The routine then proceeds to a delay Step 1070. If at Step 1040 the controller determines that no flag was set, the routine proceeds to the delay Step 1070, before continuing around the loop to Step 1030.

[0025] Figure 3 shows the WRITE COMMAND interrupt service routine (ISR) 3000. The circular block 3010 labelled "ON EACH I2C WRITE..." denotes the start of the ISR. This ISR is called on each I2C WRITE command received from the master (car-side electronics).

[0026] In this procedure the car-side electronics informs the module which diodes should be ON and which OFF (also the data received contains backlight state).

[0027] At the first Step 3020, received binary data (e.g. 0xAB 0x06 0x83) is translated into semantic functions states, (e.g. SPORT diode should be off, SPORT PLUS diode should be on, Active suspension diode: both on, etc.).

[0028] At the next step 3030 the microcontroller just sets the outputs according to the received data.

[0029] Then, at the next step 3040 the new functions states are stored into variables in RAM. This information is used later when the engine is started, to determine whether button-pressing simulation is required. The routine ends at 3050.

[0030] The above ISR is executed approximately 25 times a second.

[0031] Figure 4 also shows an interrupt service routine (ISR) generally at 4000. The circular block 4010 labelled "ON EACH I2C READ..." annotates the start of the ISR. This ISR is called on each I2C READ command received from the master (car-side electronics).

[0032] In this procedure the module has to reply with information about buttons' states (e.g. first button: not pressed, second button: pressed, third button: not pressed, etc.).

[0033] At step 4020 the microcontroller checks whether a SIMULATE BUTTON PRESS flag is currently set. This is related to Step 5020 labelled 'SET SIMULATE_BUTTON_PRESS' flag (discussed below with reference to Fig. 5) and also looks at actual button inputs.

[0034] At step 4030 a check is made as to the button input state. If a button has been pressed since the last check then a BUTTON PRESSED flag is set at step 4040 and then at step 4050 a response buffer is prepared from a lookup table. If at step 4020 it is determined that no

flag is set, or if at step 4030 it is determined that no button has been pressed, the process moves straight to step 4050.

[0035] After these steps, the controller has the requisite information to pass to the car-side electronics (e.g. SPORT button is pressed).

[0036] At step 4040 the semantic data (e.g. 'SPORT button is pressed') is converted into binary data (e.g. 0xDE 0x63 0xA2).

[0037] Then the binary data is sent to the I2C master at Step 4060 and the routine stops at Step 4070. Again, the above ISR is executed approximately 25 times a second.

[0038] Turning to Figure 5, this shows generally at 5000 an ENGINE STARTED subroutine. The circular block 5010, labelled ENGINE STARTED ROUTINE denotes the start. At Step 5020 a check is made as to whether the saved functions' states are different from their current states. If there is a difference, at Step 5030, a SIMULATE BUTTON PRESS flag is set (see Step 4020 in Fig 4). Then, after a delay step 5040, the SIMULATE BUTTON PRESS flag is cleared at Step 5050. The routine ends at Step 5060. If at Step 5020 it is determined that the saved functions' states are the same as their current states, then the routine moves straight to Step 5060.

[0039] Embodiments of the present invention facilitate the storing of driver-selected functions and settings so that these can be implemented after an ignition cycle, without requiring the driver to re-select them. Preferred embodiments do this by detecting the state of selectable actuators, preferably detecting the state of indicators (such as LEDs) of those actuators and comparing the status with a stored value.

[0040] When a difference is detected, the apparatus simulates the status of the actuator according to the stored status and represents this to the vehicle management, through the interface. A prompt for this action is the detection of an ignition event, which is determined by monitoring a voltage drop.

[0041] Examples of functions/settings, including clusters of settings, that the apparatus may interact with may include (but are not limited to) : sports mode, sports plus mode, stop start, exhaust settings, suspension settings etc.

[0042] The apparatus may take the form of additional or replacement circuit boards (PCBs) or a plug-in module and is particularly suited to storing driver-selected settings from actuators (e.g. buttons or switches) mounted in a centre-console of a vehicle, such as a Porsche (RTM) Macan (RTM) for example.

[0043] In the example, the vehicle's centre console driver's settings use "I2C" as a communication and control protocol from the factory. To retain full functionality and OEM feel, the data flowing through that area for all of the buttons and their corresponding effects on each other was reverse engineered along with the physical circuit board's shape and features. Physical additions were made to allow for the memory function, and control logic was provided in additional programming language, which the vehicle does not interact with.

[0044] A key benefit of this approach is that the vehicle still operates in its intended and original way (but with the addition of the memory features) whilst the result is essentially of OEM quality and fit and is indistinguishable from the factory set up. Rather than being a simple work around to achieve the functionality, the vehicle does not even recognize that anything has been changed in its systems.

[0045] The outcome is an automated replication of human interaction with the vehicle's own settings which follows all of the safety and control parameters of the original, whilst adding the much-needed memory feature to greatly enhance the experience of driving the vehicle.

[0046] By replicating the original physical circuit board's design and location, the installation for the apparatus is relatively swift and easy and with the apparatus having no external cases, harnesses or adaption connectors (female-male, male-female, as would be the case for a "man in the middle" approach) the apparatus will last as long as the OEM parts and cause no problem with the vehicle.

[0047] Whilst endeavouring in the foregoing specification to draw attention to those features of the invention believed to be of particular importance, it should be understood that the applicant claims protection in respect of any patentable feature or combination of features referred to herein, and/or shown in the drawings, whether or not particular emphasis has been placed thereon.

Claims

1. Apparatus for maintaining driver-selected settings in a vehicle, the apparatus comprising a controller for controlling the operation of the apparatus, a memory device for storing driver-selectable vehicle settings data, a connector for connecting the apparatus to a vehicle and at least one status sensor for detecting a status or value of at least one driver-selectable vehicle setting, wherein the apparatus is arranged in use to be connected to a vehicle and to detect and store driver-selectable settings of the vehicle, so that driver preferences for settings are preserved after operation of the vehicle is ended by turning off the ignition.

2. Apparatus according to Claim 1, wherein the memory device is a non-volatile memory, such as an EEPROM.

3. Apparatus according to Claim 1 or 2, wherein the apparatus includes an engine-start sensor arranged in use to detect an engine-start event.

4. Apparatus according to any of the preceding claims,

wherein the one or more status sensor is arranged in use to detect a setting actuator status, more preferably a condition, value, position or configuration of, or associated with, a setting actuator.

5. Apparatus according to Claim 4, wherein the apparatus detects the status of a setting actuator by detecting the status (ie ON or OFF) of an indicator associated with the actuator.

6. Apparatus according to Claim 4 or 5, wherein the apparatus is arranged in use to register the status of one or more settings actuators and to store this in the memory.

7. Apparatus according to any of Claims 4-6 when dependent on Claim 3, wherein, after an engine start event has been determined, the apparatus is arranged to simulate the stored status of the or each settings actuator.

8. A method of maintaining driver-selected settings in a vehicle, the method comprising detecting a status or value of at least one driver-selectable vehicle setting and storing the driver-selectable vehicle setting in a memory so that driver preferences for settings are preserved after operation of the vehicle is ended by turning off the ignition.

9. A method according Claim 8, wherein the method includes detecting an engine-start event.

10. A method according to Claim 8 or 9, wherein the method includes detecting a setting actuator status, more preferably a condition, value, position or configuration of a setting actuator, which may comprise a button.

11. A method according to Claim 10, wherein the method includes registering the status of one or more settings actuators and storing this in a memory.

12. A method according to Claim 11, wherein after an engine start event has been determined, the method includes simulating the stored status of the or each settings actuator.

13. A computer programme product on a computer readable medium, comprising instructions that, when executed by a computer, cause the computer to perform a method of maintaining driver-selected settings in a vehicle in accordance with any of Claims 8-12.

14. A program for causing a device to perform a method according to any of Claims 8-12.

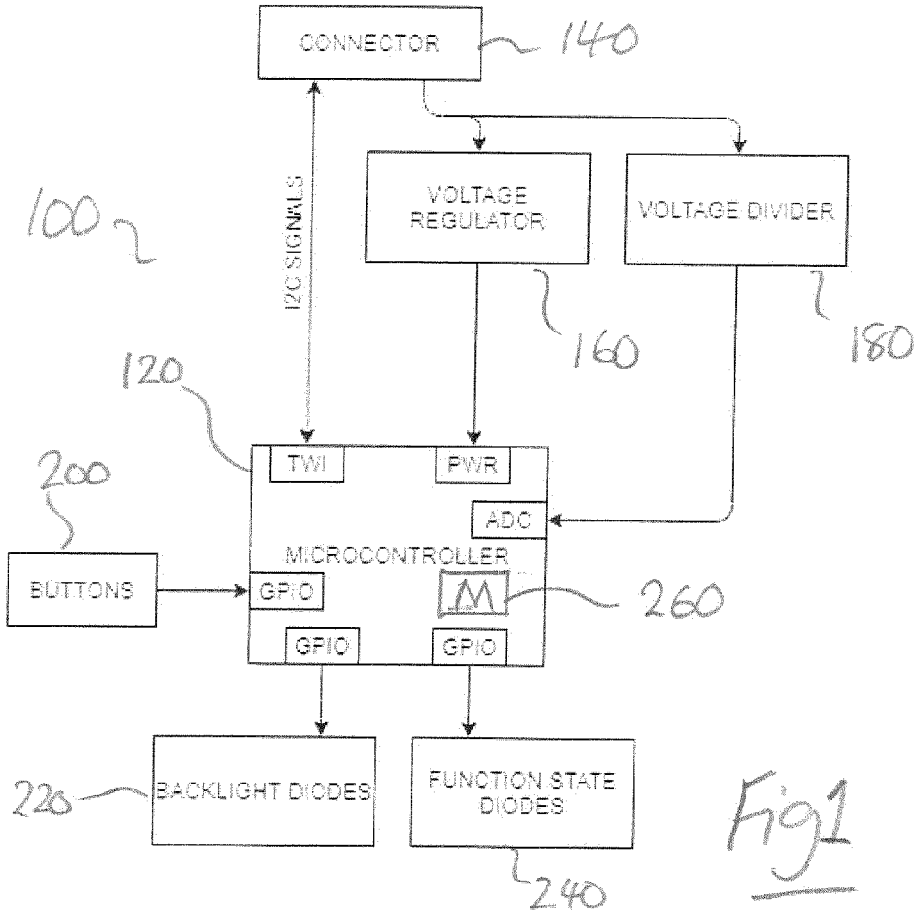
CONNECTOR
140
100
I2C SIGNALS
VOLTAGE REGULATOR
VOLTAGE DIVIDER
160
180
120
200
TWI
PWR
ADC
MICROCONTROLLER
BUTTONS
GPIO
260
GPIO
GPIO
220
BACKLIGHT DIODES
FUNCTION STATE DIODES
240

Fig1

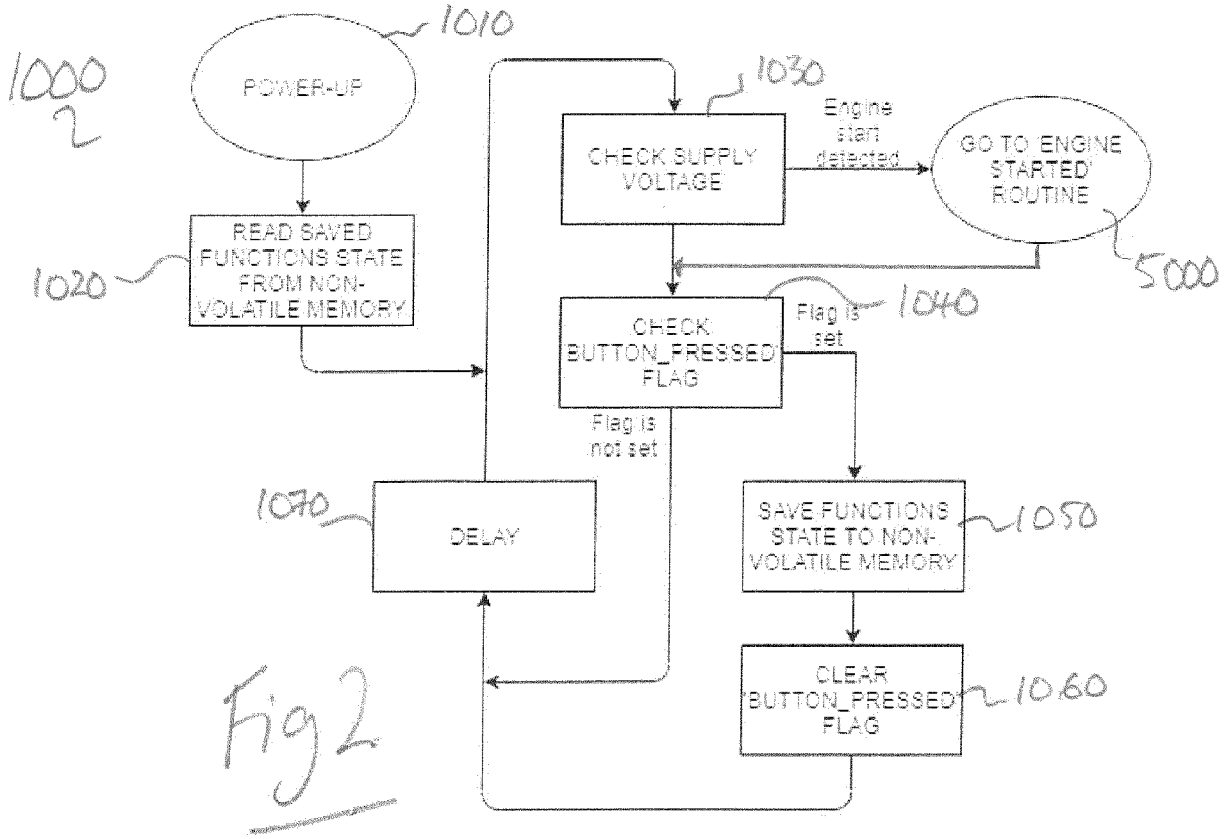
1000
1010
POWER-UP
1030
CHECK SUPPLY VOLTAGE
Engine start detected
GO TO 'ENGINE STARTED' ROUTINE
5000
READ SAVED FUNCTIONS STATE FROM NON-VOLATILE MEMORY
1020
1040
CHECK 'BUTTON_PRESSED' FLAG
Flag is set
Flag is not set
1070
DELAY
SAVE FUNCTIONS STATE TO NON-VOLATILE MEMORY
1050
CLEAR 'BUTTON_PRESSED' FLAG
1060

Fig2

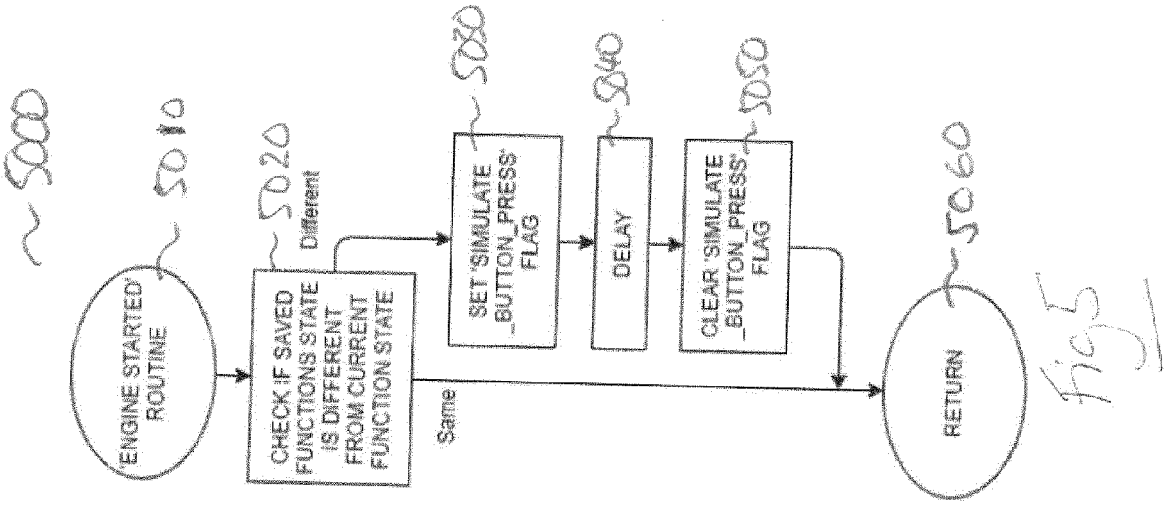

fig5

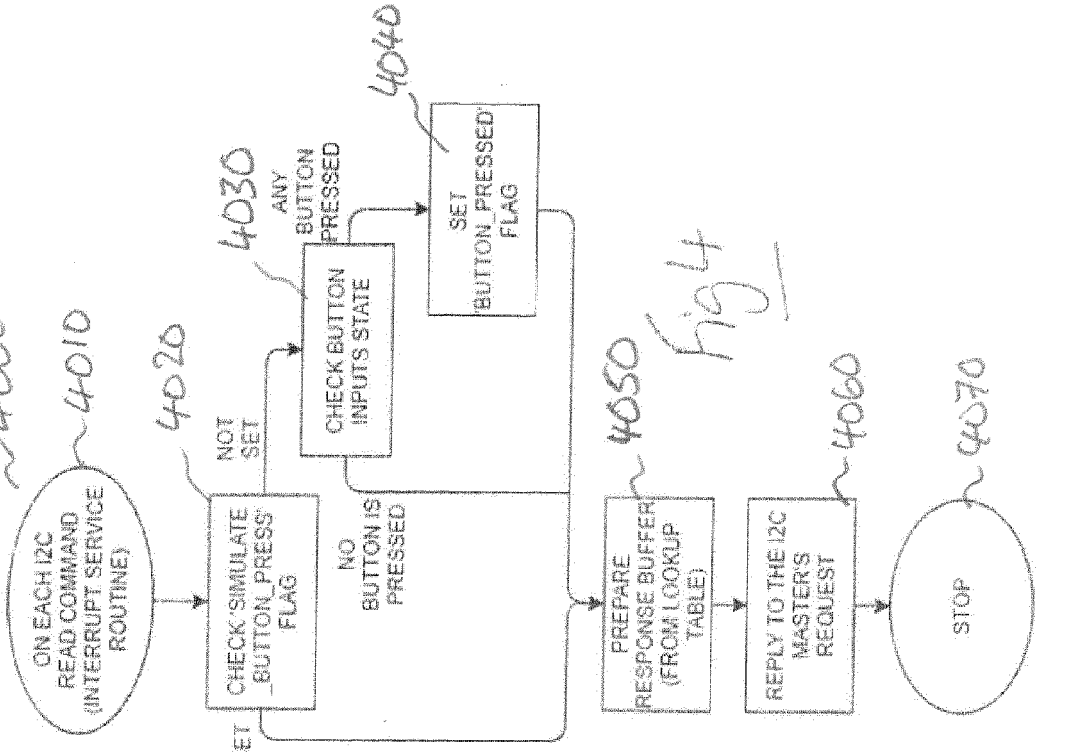

fig4

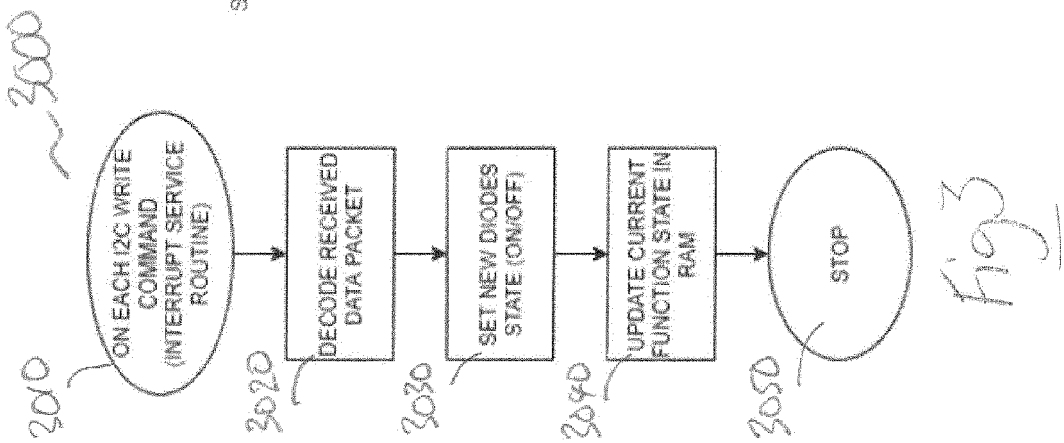

fig3

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EUROPEAN SEARCH REPORT

Application Number
EP 20 18 5999

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 2020/164878 A1 (ORANTES JUSTIN [US] ET AL) 28 May 2020 (2020-05-28) * claim 1 * * figures 1B, 3, 4 * * paragraph [0004] - paragraph [0011] * * paragraph [0026] - paragraph [0037] * -----	1-14	INV. G07C5/08 ADD. B60W50/08
X	US 2003/078709 A1 (YESTER JOHN LORING [US] ET AL) 24 April 2003 (2003-04-24) * claims 5-8 * * figures 1-3 * * paragraph [0015] - paragraph [0025] * -----	1-14	
X	US 2011/087385 A1 (BOWDEN UPTON BEALL [US] ET AL) 14 April 2011 (2011-04-14) * figures 1, 3 * * paragraph [0023] - paragraph [0027] * -----	1-14	

TECHNICAL FIELDS SEARCHED (IPC)
G07C B60W

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	2 December 2020	Hniene, Badr

CATEGORY OF CITED DOCUMENTS

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02-12-2020

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2020164878 A1	28-05-2020	NONE	
US 2003078709 A1	24-04-2003	NONE	
US 2011087385 A1	14-04-2011	DE 102010041771 A1	07-07-2011
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