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(56) Documents Cited:  
**WO 2015/008104 A1** **DE 102016211893 A1**  
**US 20220076600 A1** **US 20200117412 A1**  
**US 20200019482 A1** **US 20070046670 A1**

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 INT CL **B60K, B60Q, G01R, G06F, G09G, H03M**  
 Other: **WPI, EPODOC**

(54) Title of the Invention: **Displaying warning message and method thereof**  
 Abstract Title: **Digital display apparatus for displaying warning message and method thereof**

(57) A digital display apparatus (100) for displaying a warning message is disclosed. The digital display apparatus (100) may include a display (190); a processor (110) connected to the display (190), wherein the processor (110) is configured to: receive the warning message from at least one cluster sensor (195) of a vehicle, wherein the warning message comprises graphics information of the warning message; verify the graphics information of the warning message; and display the warning message on the display (190) if the graphics information is correct. The digital display apparatus maybe a pure software solution embedded in another system.

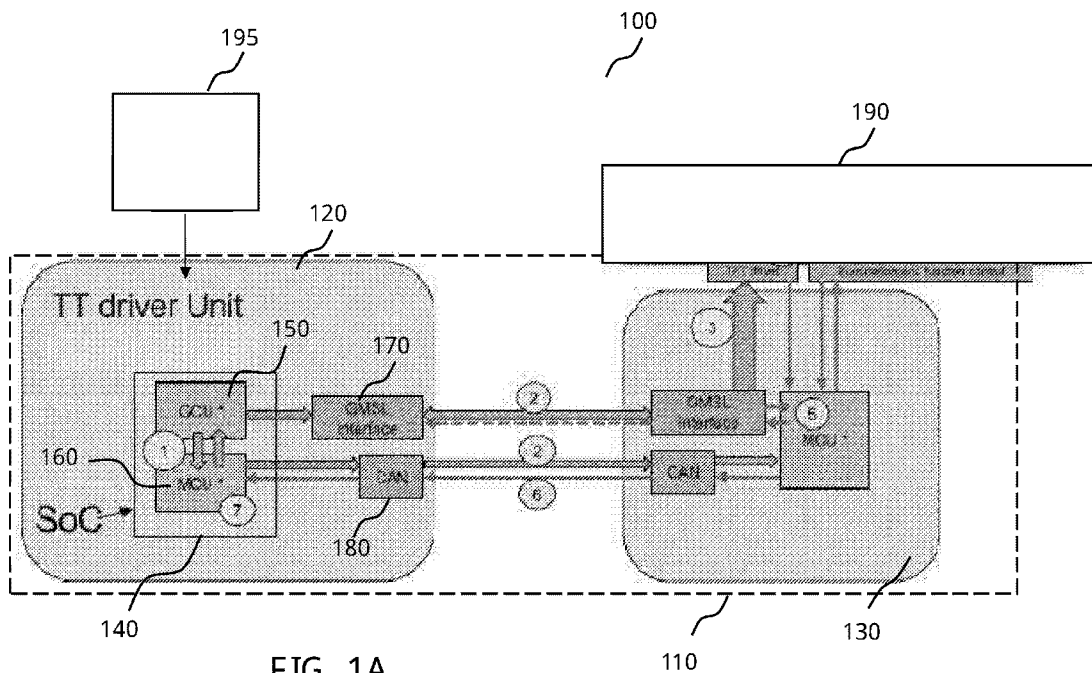


FIG. 1A

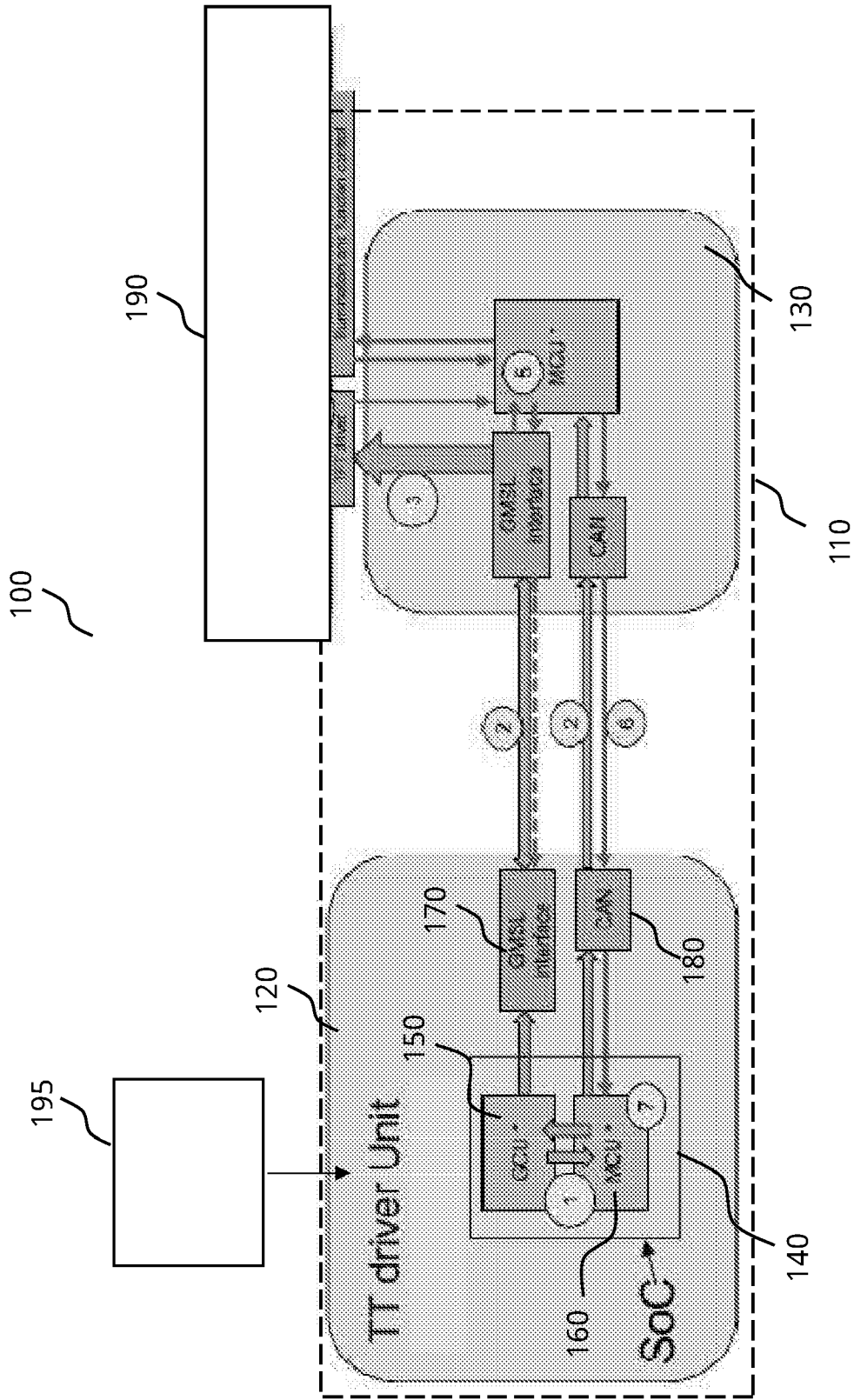


FIG. 1A

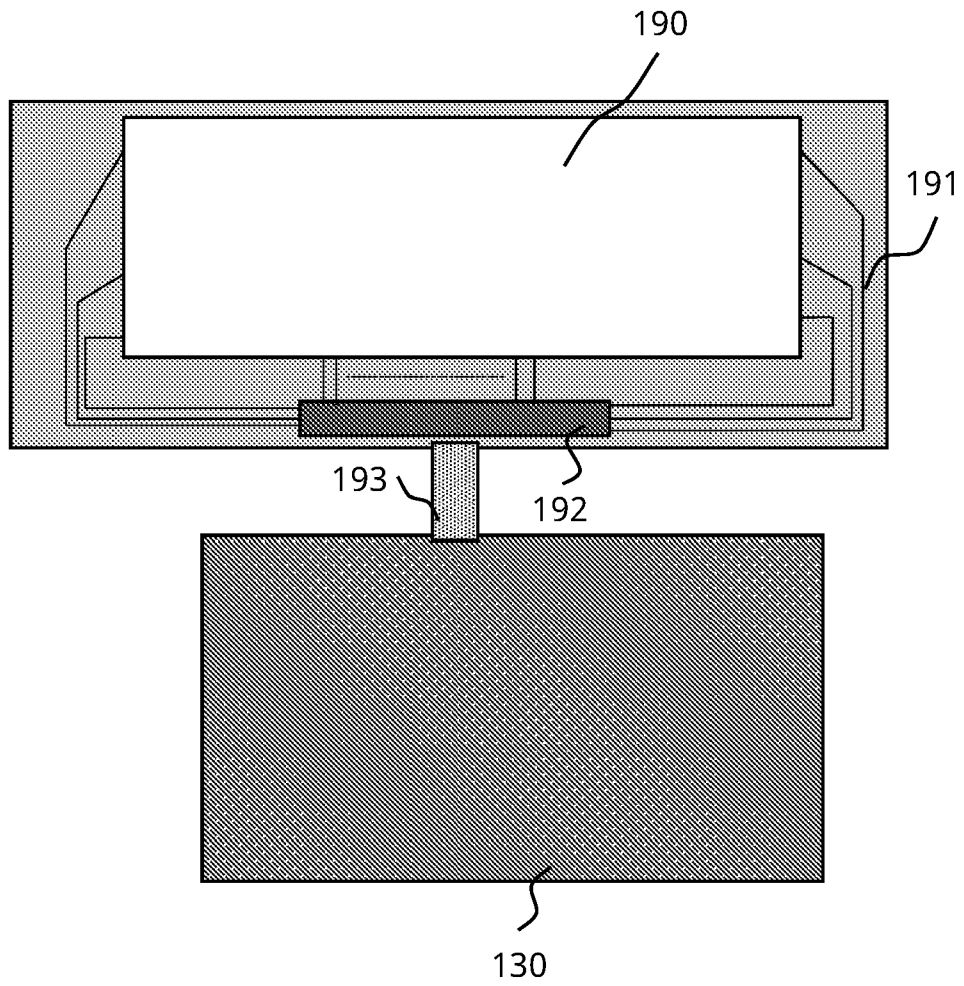


FIG. 1B

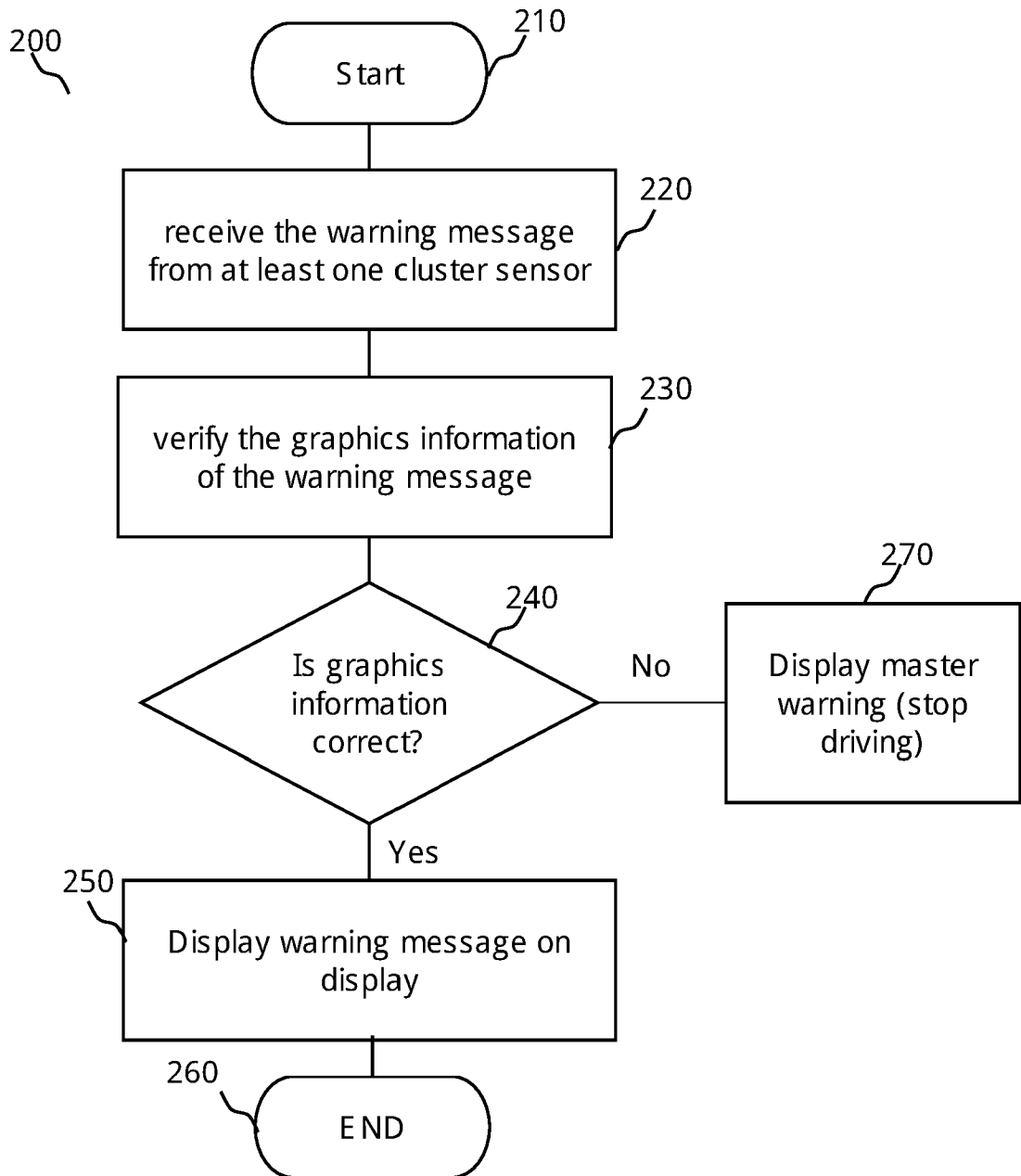


FIG. 2

## DIGITAL DISPLAY APPARATUS FOR DISPLAYING WARNING MESSAGE AND METHOD THEREOF

### DESCRIPTION

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The present disclosure relates to an digital display apparatus for displaying a warning message. The present disclosure further relates to a method for displaying a warning message.

31 Fail functions in the car such as brake, coolant water indication, oil level warning etc., are indicated to the driver by powering its respective bulbs or Light Emitting Diodes (LEDs) in the vehicle in order to provide the warning messages to the users. In order to ensure functional safety of road vehicles, a risk classification system defined by the ISO 26262 standard called Automotive Safety Integrity Level (ASIL A, B, C, D) is implemented. To save cost LEDs/functions have moved towards electronic displays instead.

Thus, there exists a need to provide a safety mechanism to ensure the accuracy or the presence of the warning messages when it occur.

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The invention is set out in the appended set of claims.

33 Various embodiments generally relate to an digital display apparatus for a vehicle. The digital display apparatus may communicate and/or display vehicle parameters or information to a driver of the vehicle. The vehicle parameters or information may include, but not limited to, one or more of an oil pressure, a fuel level, an engine temperature, a brake health or a battery voltage. Accordingly, the digital display apparatus may include or may display a speedometer, an odometer, a tachometer, an oil pressure gauge, a fuel level gauge, an engine temperature gauge, brake sensor or a battery voltage indicator.

Further, the digital display apparatus may be connected (e.g. electrically connected), either directly or via a vehicle communication network (e.g. Controller Area Network, Gigabit Multimedia Serial Link, Ethernet, etc.), to one or more system(s), module(s),

and/or sensor(s), etc. of the vehicle for receiving the vehicle parameters or information from such system(s), module(s), and/or sensor(s), etc. of the vehicle. The received vehicle parameters or information may then be communicated and/or displayed by the digital display apparatus to the driver of the vehicle, for example through a display of the digital display apparatus.

According to various embodiments, the digital display apparatus may be an electronic digital display apparatus, a digital instrument panel, or a digital dash, etc. Further, the digital display apparatus may usually be disposed at a front of the vehicle cabin of the vehicle so as to be in front of the driver of the vehicle.

Various embodiments provide an digital display apparatus that may communicate and/or display warning to the driver when at least one of the vehicle parameters are not working well (e.g., are abnormal, outside of a predetermined range).

According to various embodiments, an digital display apparatus for displaying a warning message is disclosed. The digital display apparatus may include a display. The digital display apparatus may also include a processor which may be connected to the display. The processor may be configured to receive the warning message from at least one cluster sensor of a vehicle. The warning message may include graphics information of the warning message. The processor may be configured to verify the graphics information of the warning message. The processor or system may be configured to display the warning message on the display if the graphics information is correct. The warning message may be in graphic form or textual form or a combination and may have an acoustic signal.

According to various embodiments, the graphics information of the warning message may include pixels designated for a warning indicator on the display and colour of the warning indicator.

According to various embodiments, the warning message is coded in a video stream with a checksum.

According to various embodiments, the processor may include a microcontroller and a graphics controller or combined SoC which embedded the function. The microcontroller may be configured to receive the warning message and the graphics controller may be configured to verify the graphics information of the warning message.

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According to various embodiments, the warning message may include a display location information on the display to display the warning message.

According to various embodiments, the digital display apparatus may include a communication bus configured for communication between the processor and the display. The communication bus may be a Controller Area Network (CAN) bus or a Gigabit Multimedia Serial Link (GMSL) connector or equivalent e.g., Ethernet.

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According to various embodiments, an digital display apparatus system may include an digital display apparatus and at least one cluster sensor.

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According to various embodiments, the at least one cluster sensor comprises any one or a combination of an oil pressure sensor, a fuel level sensor, an engine temperature sensor, a brake sensor or a battery voltage sensor.

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According to various embodiments, a vehicle may include the digital display apparatus system.

The vehicle is, for example, a motor vehicle, such as a car, bus or truck, or else a rail vehicle, a ship, an aircraft, such as a helicopter or aircraft.

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In the following description, various embodiments are described with reference to the following drawings, in which:

FIGS. 1A and 1B show an digital display apparatus for displaying a warning message according to various embodiments.

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FIG. 2 shows a flowchart of a cycle of operation of the digital display apparatus according to various embodiments.

In the drawings, like reference characters generally refer to the same parts throughout the different views. The drawings are not necessarily to scale, emphasis instead generally being placed upon illustrating the principles of the invention.

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Embodiments described below in context of the apparatus are analogously valid for the respective methods, and vice versa. Furthermore, it will be understood that the embodiments described below may be combined, for example, a part of one embodiment may be combined with a part of another embodiment.

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It should be understood that the terms `on\_`, `over\_`, `top\_`, `bottom\_`, `down\_`, `side\_`, `back\_`, `left\_`, `right\_`, `front\_`, `lateral\_`, `side\_`, `up\_`, `down\_` etc., when used in the following description are used for convenience and to aid understanding of relative positions or directions, and not intended to limit the orientation of any device, or

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structure or any part of any device or structure. In addition, the singular terms `a\_`, `an\_` and `the\_` include plural references unless context clearly indicates otherwise. Similarly, the word `or\_` is intended to include `and\_` unless the context clearly indicates otherwise.

FIGS. 1A and 1B show an digital display apparatus 100 for displaying a warning message according to various embodiments.

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According to various embodiments, the digital display apparatus digital display apparatus 100 may include a processor 110. The processor 110 may include a driver unit controller 120 and a display unit controller 130.

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In various embodiments, the driver unit controller 120 may include a system on chip (SOC) 140 which may include a graphics controller unit (GCU) 150 and a microcontroller (MCU) 160. In various embodiments, the driver unit controller 120 and the display unit controller 130 are connectable or connected (e.g. electrically connected), either directly or via a vehicle communication network such as Gigabit Multimedia Serial Link (GMSL) connector 170 and/or Controller Area Network (CAN) connector 180.

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In various embodiments, the processor 110 may be a high performance computing (HPC) unit. High performance computing (HPC) is the ability to process data and perform complex calculations at high speeds. The processor 110 may include a plurality of servers which may be networked together. Software programs and algorithms are run simultaneously on the servers in the HPC unit. The plurality of servers may work in parallel with each other, boosting processing speed to deliver high performance computing.

According to various embodiments, the digital display apparatus 100 may be configured to communicate and/or display the vehicle parameters or information to the driver of the vehicle. For example, the digital display apparatus 100 may include or may display, but not limited to, one or more of a speedometer, an odometer, a tachometer, an oil pressure gauge, a fuel level gauge, an engine temperature gauge, or a battery voltage indicator for communicating and/or displaying vehicle parameters or information such as vehicle speed, mileage, rotation speed, oil pressure, fuel level, engine temperature, or battery voltage respectively.

According to various embodiments, the digital display apparatus 100 may be connectable or connected (e.g. electrically connected), either directly or via a vehicle communication network (e.g. Controller Area Network, Ethernet, etc.), to one or more system(s), module(s), and/or sensor(s), etc. of the vehicle for receiving the vehicle parameters or information from such system(s), module(s), and/or sensor(s), etc. of the vehicle. Hence, the digital display apparatus 100 may serve as a user interface for communication and/or displaying received vehicle parameters or information to the driver of the vehicle (e.g. through visual means). According to various embodiments, the digital display apparatus 100 may be an electronic digital display apparatus, a digital instrument panel, or a digital dash, etc.

According to various embodiments, the driver unit controller 120 may be a warning generation and control Unit. The driver unit controller 120 may include a Cluster Meter, a Silverbox, a HPC unit, and a Cockpit Domain Controller.

According to various embodiments, the digital display apparatus 100 may include a display 190. The display 190 of the digital display apparatus 100 may serve as the

visual means for communicating and/or displaying received vehicle parameters or information to the driver of the vehicle.

According to various embodiments, the display 190 may be part of a display system 系 which includes wires 191, display driver 192 and display driver interface 193. The display 190 may be connected to the display unit controller 130 through the wires 191, the display driver 192 and the display driver interface 193.

According to various embodiments, the warning message (display content) may be 生 generated or computed or rendered in the system on chip (SOC) 140 which may be transferred over to different channels and/or modules for processing and verification. During the rendering of the warning image or warning video, graphics information such as the position (i.e., coordinates on the display 190), and type of graphics and colour of graphics is known.

According to various embodiments, one portion of the display 190 may be defined 系 according to Human Machine Interface (HMI) definition to indicate a warning function with a graphic symbol or pictograph. Since different countries may have different safety requirements, the symbol, colour and size of the warning function may be 生 defined according to local legal requirements. In various embodiments, in addition to a graphic symbol, a textual warning may also be displayed to further inform the driver of the risk.

In various embodiments, the microcontroller (MCU) 160 may receive the warning 生 message from at least one cluster sensor 195 of a vehicle. The graphics controller unit (GCU) 150 may verify the graphics information of the warning message. The microcontroller (MCU) 160 and the graphics controller unit (GCU) 150 may be configured to pass the warning message to the display unit controller 130 for displaying on display 190 if the graphics information of the warning message is correct.

In various embodiments, the at least one cluster sensor 195 may include any one or 生 a combination of an oil pressure sensor, fuel level sensor, engine temperature sensor, brake sensor or battery voltage sensor. The at least one cluster sensor 195 may include car interfaces such as Controller Area Network (CAN) connector and Ethernet.

系 In various embodiments, the graphics information of the warning message may include pixels designated for a warning indicator on the display and colour of the warning indicator. For example, if the oil pressure is too high, the processor 110 may show an oil pressure warning message on the display 190 in graphic form or textual form or a combination in a specific colour (e.g., red).

系 According to various embodiments, the warning message may be coded in a video stream with a checksum. A checksum may be a sequence of numbers and letters used to check data for errors. In various embodiments, after the graphics controller unit (GCU) 150 verifies the accuracy of the warning message, the graphics controller unit (GCU) 150 may send the warning message to the display unit controller 130 through the Gigabit Multimedia Serial Link (GMSL) connector 170. The microcontroller (MCU) 160 may also send a status feedback indicating that the warning message is accurate to the display unit controller 130 through the Controller Area Network (CAN) connector 180.

系 According to various embodiments, the warning message may be defined in the HMI. The warning message may include information such as icon, graphic, colour, size and location of the warning message. The driver unit controller 120 relies on the graphic and function layout information to indicate the warning message.

系 According to various embodiments, prior to displaying the warning message, a checksum is generated. The checksum is compared with an initial value. If both are identical, the system determines that the video signal is correct. The display unit controller 130 sends the signal through the wires 191, the display driver 192 and the display driver interface 193 to the display 190 to display the warning message to the user.

系 According to various embodiments, the display driver 192 receives the order to watch specific pixel (position, Colour, brightness, presence) and send the result back to the driver unit 120. The feedback information in time is part of the checksum check. The system sends information such as display, illumination, signal integrity condition back to the driver unit 120 for checking against the checksum.

In various embodiments, the display unit controller 130 may also include a microcontroller (MCU) which may verify that the warning message and the status feedback is received from the driver unit controller 120 before sending the warning message to display 190. A display driver may verify the coded checksum and display the appropriate graphical image or text.

According to various embodiments, the display 190 may be an analogue display or an electronic/digital display or a combination of an analogue and an electronic/digital display. According to various embodiments, the display 190 may include one or a combination of a speedometer face, an odometer readout, a tachometer face, an oil pressure gauge face, a fuel level gauge face, a fuel level indicator/readout, an engine temperature readout, a battery voltage indicator/readout, a speed readout, a gear position indicator, a fuel consumption indicator/readout, etc.

According to various embodiments, at least one portion of the display 190 may be an electronic/digital display. The electronic/digital display may include, but not limited to, a liquid crystal display (LCD), a thin-film transistor display (TFT), a light-emitting diode display (LED), a quantum dot display (QLED), an organic light-emitting diode display (OLED), an active-matrix organic light-emitting diode display (AMOLED), or a plasma display panel (PDP). According to various embodiments, the entire display 190 of the digital display apparatus 100 may be an electronic/digital display.

According to various embodiments, an digital display apparatus system may include an digital display apparatus 100 and at least one cluster sensor 195.

According to various embodiments, the at least one cluster sensor 195 comprises any one or a combination of an oil pressure sensor, a fuel level sensor, an engine temperature sensor, a brake sensor or a battery voltage sensor.

According to various embodiments, a vehicle may include the digital display apparatus system.

The vehicle is, for example, a motor vehicle, such as a car, bus or truck, or else a rail vehicle, a ship, an aircraft, such as a helicopter or aircraft.

系 In various embodiments, instead of having a separate display unit controller 130, the embodiments disclosed herein may be processed by the system on chip 140 in the driver unit controller 120.

系 According to various embodiments, the term `processor\_ encompasses all kinds of apparatus, devices, and machines for processing data, including by way of example a programmable processor, a computer, a system on a chip (i.e. SoC), or multiple ones, or combinations, of the foregoing. The `processor\_ may include special purpose logic circuitry, e.g., an FPGA (field programmable gate array) or an ASIC (application specific integrated circuit). The `processor\_ may also include, in addition to hardware, code that creates an execution environment for the computer program in question, e.g., code that constitutes processor firmware, a protocol stack, a database management system, an operating system, a cross-platform runtime environment, a virtual machine, or a combination of one or more of them.

系 According to various embodiments, some of the processes and logic flows described in this specification may be performed by one or more processors executing one or more computer programs to perform actions by operating on input data and generating output. The processes and logic flows may also be performed by, and apparatus may also be implemented as, special purpose logic circuitry, e.g., an FPGA (field programmable gate array) or an ASIC (application specific integrated circuit).

系 According to various embodiments, a computer program (also known as a program, software, software application, script, or code) may be written in any form of programming language, including compiled or interpreted languages, declarative or procedural languages, and it may be deployed in any form, including as a stand-alone program or as a module, component, subroutine, object, or other unit suitable for use in a computing environment. A computer program may, but need not, correspond to a file in a file system. A program may be stored in a portion of a file that holds other programs or data (e.g., one or more scripts stored in a markup language document), in a single file dedicated to the program, or in multiple coordinated files (e.g., files that

store one or more modules, sub programs, or portions of code). A computer program may be deployed to be executed on one computer or on multiple computers that are located at one site or distributed across multiple sites and interconnected by a communication network.

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According to various embodiments, the digital display apparatus 100 may carry out the various processes using a memory. According to various embodiments, memory used in the various embodiments may be a non-volatile memory, for example a PROM (Programmable Read Only Memory), an EPROM (Erasable PROM), EEPROM (Electrically Erasable PROM), ROM (Read-Only Memory) or a flash memory, e.g., a floating gate memory, a charge trapping memory, an MRAM (Magnetoresistive Random Access Memory) or a PCRAM (Phase Change Random Access Memory).

系 In various embodiments, there is provided a computer program product, embodied in one or more computer-readable storage mediums (non-transitory computer-readable storage medium(s)), comprising instructions executable by one or more computer processors to perform the method of displaying a warning message, as described herein with reference to FIG. 1 according to various embodiments. Accordingly, various computer programs or modules described herein may be stored in a computer program product receivable by a system therein, for execution by the processor 110 to perform various functions.

FIG. 2 shows a flowchart of an exemplary method 200 of displaying a warning message by means of an digital display apparatus 100 described above.

In Step 210, the method 200 of displaying a warning message begins.

系 In step 220, the microcontroller (MCU) 160 may receive the warning message from at least one cluster sensor of a vehicle. In various embodiments, the at least one cluster sensor may include any one or a combination of an oil pressure sensor, fuel level sensor, engine temperature sensor, brake sensor or battery voltage sensor. According to various embodiments, the warning message may be coded in a video stream with a checksum.

In step 230, the graphics controller unit (GCU) 150 may verify the graphics information of the warning message. The graphics information of the warning message may include pixels designated for a warning indicator on the display and colour of the warning indicator.

At Step 240, the graphics information of the warning message is verified. If the graphics information is correct, the method proceeds to step 250.

At step 250, the warning message is displayed on the display 190 based on the graphic information provided in the warning message. The method proceeds to step 260 and ends.

If the graphics information is not correct, for example if a colour or position of pixels is not correct, the method proceeds to step 270. At step 270, a master defect will be generated and stored in the failure storage of the car (for service information). A master warning will be generated to instruct the driver either to stop immediately the car or instruct to visit a service station. This new warning is in alignment with the overall system responsible (Car- Level) to be defined to achieve the necessary FIT-Rate (Failure in Time) of the whole car.

While embodiments of the invention have been particularly shown, and described with reference to specific embodiments, it should be understood by those skilled in the art that various changes in form and detail may be made therein without departing from the scope of the invention as defined by the appended claims. The scope of the invention is thus indicated by the appended claims and all changes which come within the meaning of the claims are therefore intended to be embraced.

## Reference Signs List

	100	digital display apparatus
	110	processor
系	120	driver unit controller
	130	display unit controller
	140	system on chip (SOC)
	150	graphics controller unit (GCU)
	160	microcontroller (MCU)
孔	170	Gigabit Multimedia Serial Link (GMSL) connector
	180	Controller Area Network (CAN) connector
	190	display
	191	wires
	192	display driver
系	193	display driver interface
	195	cluster sensor



## Claims

1. An digital display apparatus (100) for displaying a warning message comprising:  
a display (190);  
系 a processor (110) connected to the display (190), wherein the processor (110) is configured to:  
receive the warning message from at least one cluster sensor (195) of a vehicle, wherein the warning message comprises graphics information of the warning message;  
verify the graphics information of the warning message; and  
改 display the warning message on the display (190) if the graphics information is correct.
2. The digital display apparatus (100) of claim 1, wherein the graphics information of the warning message comprises pixels designated for a warning indicator on the display (190) and colour of the warning indicator.  
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3. The digital display apparatus (100) of claims 1 or 2, wherein the warning message is coded in a video stream with a checksum.
4. The digital display apparatus (100) of any of claims 1 to 3, wherein the processor (110) comprises a microcontroller (160) and a graphics controller (150), wherein the microcontroller (160) is configured to receive the warning message and the graphics controller (150) is configured to verify the graphics information of the warning message.  
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5. The digital display apparatus (100) of any of claims 1 to 4, wherein the warning message comprises display location information on the display (190) to display the warning message.  
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6. The digital display apparatus (100) of any of claims 1 to 5, further comprising a communication bus configured for communication between the processor and the display, wherein optionally the communication bus is a Controller Area Network (CAN) bus (180) or a Gigabit Multimedia Serial Link (GMSL) connector (170).  
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7. An digital display apparatus system, comprising:

an digital display apparatus (100) of any one of claims 1 to 6; and  
at least one cluster sensor (195).

8. The digital display apparatus system of claim 7,  
系 wherein the at least one cluster sensor (195) comprises any one or a combination of an oil pressure sensor, a fuel level sensor, an engine temperature sensor, a brake sensor or a battery voltage sensor.
9. A vehicle comprising an digital display apparatus system of claim 7 or 8.  
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10. A method for displaying a warning message comprising:  
receiving a warning message from at least one cluster sensor (195) of a vehicle by a processor (110), wherein the warning message comprises graphics information of the warning message;  
系 verifying the graphics information of the warning message by the processor (110); and displaying the warning message on a display (190) if the graphics information is correct.
11. The method of claim 10, wherein the graphics information of the warning  
系 message comprises pixels designated for a warning indicator on the display (190) and colour of the warning indicator.
12. The method of claim 10 or 11, wherein the warning message is coded in a video stream with a checksum.  
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13. The method of any of claims 10 to 12, wherein the processor (110) comprises a microcontroller (160) and a graphics controller (150), the method further comprising: receiving the warning message by the microcontroller (160); and verifying the graphics information of the warning message by the graphics controller  
系 (150).
14. The method of any of claims 10 to 13, wherein the warning message comprises display location information on the display (190) to display the warning message.

15. The method of any of claims 10 to 14, further comprising a communication bus configured for communication between the processor and the display, wherein optionally the communication bus is a Controller Area Network (CAN) bus (180) or a Gigabit Multimedia Serial Link (GMSL) connector (170).

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16. A computer program product embodied in a non-transitory computer-readable storage medium, comprising instructions executable by a processor (110) to perform the method (100) according to any one of claims 10 to 15.

31 17. A non-transitory computer-readable storage medium, comprising instructions executable by a processor (110) to perform the method (100) according to any one of claims 10 to 15.



**Application No:** GB2218437.8

**Examiner:** Damien Huxley

**Claims searched:** 1 to 17

**Date of search:** 28 April 2023

**Patents Act 1977: Search Report under Section 17**

**Documents considered to be relevant:**

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1 to 17	US2020/117412 A1 (BOSCH) See paragraphs [0005], [0015], [0016], [0026] to [0057] and the figures
X	1 to 17	WO2015/008104 A1 (FREESCALE SEMICONDUCTOR INC) See the text from line 31 of page 2 to line 14 of page 3 and the figures
X	1 to 17	US2007/046670 A1 (HEDRICK ET AL) See paragraphs [0011], [0014], [0031] to [0060] and the figures
X	1 to 17	DE102016211893 A1 (BOSCH) See the figures and the English language translation available from Google Patents at: <a href="https://patents.google.com/patent/DE102016211893A1/en?q=DE102016211893">https://patents.google.com/patent/DE102016211893A1/en?q=DE102016211893</a>
X	1 to 17	US2022/076600 A1 (CONTINENTAL AUTOMOTIVE) See paragraphs [0003] to [0005], [0009] to [0032], [0040] to [0076] and the figures
X	1 to 17	US2020/019482 A1 (LG DISPLAY CO) See paragraphs [0007] to [0009], [0027] to [0093] and the figures

**Categories:**

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

**Field of Search:**

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC<sup>X</sup> :

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Worldwide search of patent documents classified in the following areas of the IPC

B60K; B60Q; G01R; G06F; G09G; H03M
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The following online and other databases have been used in the preparation of this search report

WPI, EPODOC
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**International Classification:**

<b>Subclass</b>	<b>Subgroup</b>	<b>Valid From</b>
B60Q	0011/00	01/01/2006
G06F	0003/14	01/01/2006
G06F	0003/147	01/01/2006
G06F	0011/08	01/01/2006