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(54) **CENTRAL COMMUNICATION UNIT OF PURPOSE-BUILT VEHICLE AND METHOD OF CONFIGURING DYNAMIC NETWORK THEREOF**

ZENTRALE KOMMUNIKATIONSEINHEIT EINES ZWECKGEBUNDENEN FAHRZEUGS UND VERFAHREN ZUR KONFIGURATION EINES DYNAMISCHEN NETZES DAVON

UNITÉ CENTRALE DE COMMUNICATION D'UN VÉHICULE SPÉCIALISÉ ET PROCÉDÉ DE CONFIGURATION DE SON RÉSEAU DYNAMIQUE

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EP 4 054 127 B1

Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to and the benefit of Korean Patent Application No. 10-2021-0027682 filed on March 2, 2021.

BACKGROUND

1. Technical Field

[0002] The present invention relates to a central communication unit of a purpose-built vehicle and a method of configuring a dynamic network thereof.

2. Discussion of Related Art

[0003] Since a vehicle has a multi-master distributed processing system, information of another controller is independently required for the operation of one controller.

[0004] As the number of controllers is increased, a bandwidth is also increased. In order to satisfy such bandwidth requirements, a multi-channel controller area network (CAN), CAN flexible data-rate (FD), and Ethernet are introduced, and information transmission is required even between networks with different standards. A central communication unit (CCU) is developed for information transmission between hybrid networks and for the entire network.

[0005] FIG. 1 is a diagram illustrating various hybrid networks used in the CCU.

[0006] Since the function of the vehicle is determined at the development stage, a network configuration and transfer information are predetermined. Therefore, the number of mounted controllers and transfer information are predetermined at the vehicle development stage, and communication is performed on the basis of a predetermined database (DB).

[0007] Meanwhile, in a recently proposed purpose-built vehicle, a body module or a drive module of the vehicle can be modified according to the purpose.

[0008] In this case, since the number and type of controllers installed in each module are changed according to characteristics of the modules, it is difficult to smoothly exchange information between controllers using the existing static vehicle network configuration method.

[0009] In addition, since the configuration of a signal being used is changed according to the period when the controller is manufactured, accurate information exchange is not possible unless modules are manufactured in around the same period.

[0010] Therefore, when a module is changed in the purpose-built vehicle, it is necessary to check and adjust communication compatibility between controllers connected to the CCU. US 2010/256 860 A1 discloses a vehicle test method for detecting faults in a CAN network, using a CAN ID request command for allowing a fault detection, which is sent to each controller and a CAN ID of each controller stored in a CAN ID table is used for fault detection.

SUMMARY

[0011] The present invention is directed to providing a central communication unit (CCU) of a purpose-built vehicle, which dynamically reconfigures a network for a controller connected to the CCU as a predetermined module is changed in the purpose-built vehicle, and a method of configuring a dynamic network thereof.

[0012] However, problems to be solved by the present invention are not limited to the above problems, and other problems may exist.

[0013] According to present invention, there is provided a method of configuring a dynamic network in a CCU of a purpose-built vehicle, which is defined by claim 1.

[0014] In addition, according to another aspect of the present invention, there is provided a central communication unit (CCU), which is defined by claim 15.

[0015] The details of other example embodiments of the present invention are included in the detailed description and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] The above and other objects, features and advantages of the present invention will become more apparent to those of ordinary skill in the art by describing exemplary embodiments thereof in detail with reference to the accompanying drawings, in which:

FIG. 1 is a diagram illustrating various hybrid networks used in a central communication unit (CCU);
FIG. 2A is a flowchart for describing a process of configuring a dynamic network according to one embodiment of the present invention;
FIG. 2B is a diagram illustrating an example of vehicle communication network information after a module is changed;
FIG. 2C is a diagram illustrating an example of a network configuration after a controller responds with a diagnostic message identification (ID);
FIG. 2D is a diagram for describing a case in which diagnosis message IDs are the same;
FIG. 2E is a diagram illustrating an example of adding an arbitrary delay time when a communication failure occurs;
FIG. 2F is a diagram illustrating an example of the result of checking attribute information using a diagnostic message ID of a controller;
FIGS. 3A and 3B are flowcharts for describing a case in which message IDs of controllers connected to the same network are the same;
FIG. 4 is a flowchart for describing a process of checking communication compatibility; and
FIG. 5 is a diagram for describing a CCU according to one embodiment of the present invention.

DETAILED DESCRIPTION

[0017] Advantages, features, and implementations thereof will be apparent from embodiments which are described in detail below together with the accompanying drawings. The present invention may, however, be implemented in many different forms and should not be construed as being limited to the embodiments set forth herein, and the embodiments are provided such that this disclosure will be thorough and complete and will fully convey the scope of the present invention to those skilled in the art to which the present invention pertains, and the present invention is defined by only the scope of the appended claims.

[0018] Terms used herein are for the purpose of describing the embodiments and are not intended to limit the present invention. In this disclosure, the singular forms include the plural forms unless the context clearly dictates otherwise. It is noted that the terms "comprises" and/or "comprising" used herein does not exclude the presence or addition of one or more other components in addition to stated components. The same reference numerals refer to the same components throughout this disclosure, and the term "and/or" includes each of the stated components and one or more combination thereof. Although the terms first, second, and the like are used to describe various components, these components are substantially not limited by these terms. These terms are used only to distinguish one component from another component. Therefore, a first component described below may be substantially a second component within the technical spirit of the present invention.

[0019] Unless defined otherwise, all terms (including technical and scientific terms) used herein may be used in a sense commonly understood by those skilled in the art to which the present invention pertains. In addition, terms defined in a commonly used dictionary are not to be interpreted ideally or excessively unless specifically defined explicitly.

[0020] In the description of the present invention, a method of dynamically configuring a network when a module exchange occurs for a purpose-built vehicle will be described. In describing, a method of checking and adjusting communication compatibility between controllers will be described together.

[0021] FIG. 2A is a flowchart for describing a process of configuring a dynamic network according to one embodiment of the present invention.

[0022] Meanwhile, each operation shown in FIG. 2A may be understood to be performed by a central communication unit (CCU) 100 shown in FIG. 5, but the present invention is not necessarily limited thereto.

[0023] In the method of configuring a dynamic network according to one embodiment of the present invention, first, as a predetermined module in a purpose-built vehicle is changed, the CCU 100 broadcasts a request for a response of a diagnostic message ID to all controllers (S110).

[0024] Since all communication networks used in a vehicle are connected to the CCU 100, when a predetermined module configuration is changed, the CCU 100 should check first the connected controllers using a diagnostic message.

[0025] FIG. 2B is a diagram illustrating an example of vehicle communication network information after a module is changed. FIG. 2C is a diagram illustrating an example of a network configuration after a controller responds with a diagnostic message ID.

[0026] In this case, as shown in FIG. 2B, when the module change occurs, since the CCU 100 cannot know information on a controller connected to each network, in order to check the controller connected to each network, first, a request for responding with the diagnostic message ID used by each controller is broadcast.

[0027] Then, the CCU 100 receives the response of the diagnostic message ID from the controller corresponding to the broadcasting (S120) and checks the controller connected to each network on the basis of the received diagnostic message ID.

[0028] As shown in FIG. 2C, when each controller responds with the diagnostic message ID, the CCU 100 may know that the controller having a corresponding diagnostic message ID is connected to each communication network.

[0029] FIG. 2D is a diagram for describing a case in which diagnosis message IDs are the same. FIG. 2E is a diagram illustrating an example of adding an arbitrary delay time when a communication failure occurs.

[0030] Meanwhile, as shown in FIG. 2D, when a predetermined module is changed in the purpose-built vehicle, since a manufacturing time of the controller installed in each module may be different, the diagnostic message IDs of different controllers connected to the networks may be the same. In this case, in response to the request for the response of the diagnostic message ID, the CCU 100 may simultaneously receive responses from a controller A and a controller B, and consequently, communication between the controllers fails due to message duplication. Alternatively, when the CCU 100 communicates with the individual controller through the diagnostic message ID, it is impossible to receive information because two controllers A and B respond.

[0031] In order to solve the above problem, according to one embodiment of the present invention, it is checked whether there is a controller with a communication failure due to duplicated diagnostic message IDs among all the controllers (S130).

[0032] In addition, in the checking result, in the case of the presence of duplicated diagnostic message IDs, first, in order not to fail a request process of the response of the diagnostic message ID, when a communication failure (error frame) occurs in a corresponding response, as shown in FIG. 2E, the response of the diagnostic message ID is re-received by adding an arbitrary delay time in a retransmission process to a corresponding controller. The re-reception process is repeatedly performed until the response of the diagnostic message ID is re-received from the corresponding controller.

[0033] In this case, when a network of the controllers having the duplicated diagnostic message IDs uses Ethernet, the CCU 100 does not separately add a delay time. In the case of Ethernet, since communication is performed in a one-to-one manner, even when the duplicated diagnostic message IDs are generated, communication always succeeds, and thus no arbitrary delay time is added.

[0034] When the diagnostic message ID is re-received from the corresponding controller and thus a physical communication process succeeds, as shown in FIG. 2D, the CCU 100 may check that the controller A and the controller B use the same diagnostic message ID.

[0035] Therefore, the CCU 100 checks classification information on controllers to identify each controller and requests to change the diagnostic message ID to any one of the identified controllers (S140).

[0036] For example, the controller A and the controller B may be distinguished by classification numbers (0X01 BCM, 0X02 ACU, and the like) of the controllers, which are included in the content of the response of the diagnostic message ID. The CCU 100 checking the classification information requests to change the diagnostic message ID of the controller, whose diagnostic message ID is 1 and the classification number is B, to 2 through the broadcasting process again, and thus duplication of the diagnostic message IDs of the controller A and the controller B may be solved.

[0037] Next, the CCU 100 checks connection information of each controller on the basis of the diagnostic message ID and requests for attribute information including a transmission message, a reception message, message type information, a message signal configuration, and a database (DB) version of the controller.

[0038] In addition, the CCU 100 generates a DB by collecting responses corresponding to each attribute information request (S 150) and reactivates each controller on the basis of the generated DB to configure a dynamic network (S 160).

[0039] FIG. 2F is a diagram illustrating an example of the result of checking attribute information using a diagnostic message ID of a controller.

[0040] The CCU 100 checks an independent diagnostic message ID for each controller and then requests transmission/reception messages and message type information, a message signal configuration, and version information on the DB using the diagnostic message ID of each controller.

[0041] Then, the CCU 100 collects responses from the controllers and generates a DB as shown in Table 1 below.

[Table 1]

Network	Node	Diag ID	Tx Msg			Rx Msg			DB Ver.
			ID	Type	Signals	ID	Type	Signals	
CAN	A	1	1	C	...	2	B	...	1.0
CAN	B	2	2	B	...	3	P	...	1.0
CAN FD	C	3	3	P	...	4	C	...	1.0
CAN FD	D	4	4	C	...	5	C	...	1.0
Ethernet	E	5	5	P	...	6	C	...	1.0
Ethernet	F	6	6	C	...	1	C	...	1.0

[0042] In addition to the above description, as one example, the CCU 100 may extract some pieces of the attribute information from the generated DB to generate a routing DB (RDB). That is, in the case of a message requiring information exchange between networks, the CCU 100 may generate an RDB by extracting some information as shown in Table 2 below.

[Table 2]

ID	Type	Source Network	Destination Network
1	C	CAN	Ethernet
3	P	CAN FD	CAN
5	P	Ethernet	CAN FD

[0043] FIGS. 3A and 3B are flowcharts for describing a case in which message IDs of controllers connected to the same network are the same.

[0044] Meanwhile, in one embodiment of the present invention, there may be a case in which messages of controllers connected to the same network among all the controllers have the same ID as shown in Table 3. In this case, the CCU 100 may check whether duplicated messages are present (S210) and then adjust IDs of the duplicated messages, thereby solving a problem of the duplicated messages (S220).

[Table 3]

Network	Node	Diag ID	Tx Msg			Rx Msg			DB Ver.
			ID	Type	Signals	ID	Type	Signals	
CAN	A	1	**1**	C	...	**1**	B	...	1.0
CAN	B	2	**1**	B	...	3	P	...	1.0
CAN FD	C	3	3	P	...	4	C	...	1.0
CAN FD	D	4	4	C	...	5	C	...	1.0
Ethernet	E	5	5	P	...	6	C	...	1.0
Ethernet	F	6	6	C	...	**1**	C	...	1.0

[0045] Specifically, in order to check that the IDs having the same message are different messages, the CCU 100 compares the message type information and the message signal configuration (S221). In addition, the CCU 100 activates and removes the message on the basis of the comparison result and the priority of each controller corresponding to the duplicated messages.

[0046] As one example, in the comparison result, when the pieces of message type information and the message signal configurations of the duplicated messages are exactly the same (YES in S211), the CCU 100 activates a message of the controller having the high priority diagnostic message ID among the controllers corresponding to the duplicated messages and removes the message of the controller having the low priority (S222). That is, when two values are completely identical, the CCU 100 activates only the message corresponding to the controller with a diagnostic message ID having a low value.

[0047] Here, the priority of the diagnostic message ID has a higher priority as the value of the ID is lower.

[0048] On the other hand, in the comparison result, when at least one of the pieces of message type information and the message signal configurations of the duplicated messages is different (NO in S221), the CCU 100 increases a value of the diagnostic message ID of a controller having the low priority message ID among the controllers corresponding to the duplicated messages so as not to overlap the message IDs of the remaining controllers (S223).

[0049] When the increased value of the message ID exceeds a predetermined threshold value (YES in S224), the priority of the message is significantly lowered, and thus the CCU 100 may generate and add a diagnostic trouble code (DTC), thereby rechecking whether a module exchange process is performed normally (S225).

[0050] As described above, after the DB is configured using message information of the connected controller, the CCU 100 may perform a process of checking communication compatibility.

[0051] FIG. 4 is a flowchart for describing a process of checking communication compatibility.

[0052] Specifically, the CCU 100 matches transmission and reception message signals between the controllers on the basis of the configured DB and checks compatibility of each controller connected to the CCU 100 on the basis of

the matching result (S310). Then, the CCU 100 adjusts to maintain compatibility between the controllers which are determined to be incompatible in the checking result (S320).

[0053] In this case, in one embodiment of the present invention, the compatibility checking and adjustment methods may be differently performed on the basis of whether the CCU 100 is connected to an external Internet network.

[0054] As one example, in a state of being not connected to an external network, the CCU 100 may determine that there is a problem in compatibility on the basis of a predetermined rule.

[0055] First, in the matching result, when locations of the transmission/reception message signals do not match, the CCU 100 may determine that a compatibility problem is present in the controllers that do not match. In addition, the CCU 100 may adjust the locations of the transmission/reception message signals of the controllers that do not match to maintain compatibility between the controllers.

[0056] As another example, when the number of bits of the transmission/reception message signals does not match in a state of being not connected to an external network, the CCU 100 may determine that a compatibility problem is present in the controllers that do not match. In addition, the CCU 100 may adjust to maintain compatibility between the controllers using a transmission/reception message with a smaller number of bits of the transmit/receive message signals of the controllers that do not match.

[0057] Alternatively, when the number of bits of the transmission and reception message signals does not match in a state of being connected to an external network, the CCU 100 may inquire a corresponding content to a DB management server through an external Internet network, thereby checking compatibility.

[0058] In addition, when the controller includes version information different from the DB version information in a state in which the CCU 100 is connected to an external network, the CCU 100 may inquire a corresponding content to the DB management server through an external Internet network, thereby checking compatibility. In this case, the CCU 100 also inquires information on the mounted controller to the DB management server, and when a signal of a specific controller disappears, the CCU 100 may receive a signal of a replaceable controller to change the DB and the RDB.

[0059] As one example, when a controller among the controllers connected to the CCU 100 includes version information different from the version information on the DB configured according to the previous operation (S330), since the controller may differently interpret the same value, the CCU 100 may check compatibility of the controller on the basis of a compatibility summary table stored in the CCU 100 (S340). Since the configuration of the DB used in the vehicle is not significantly changed unless the generation changes, when a compatibility summary table is generated based on changed contents, it is possible to check whether a signal is compatible even when the DB version used by the controller is different.

[0060] In addition, when a first controller connected to the CCU 100 before being changed to a predetermined module is excluded as it is changed to the predetermined module, the CCU 100 may replace the first controller with a second controller on the basis of the matching result of the transmission/reception message signals, thereby maintaining compatibility. That is, when a required specific controller signal is not present, the CCU 100 may replace the required specific controller signal with a similar controller signal. For example, in a state in which a controller needing to receive vehicle speed information from an electronic stability control (ESC) controller is present, when the ESC controller is excluded due to module exchange in a purpose-built vehicle, the CCU 100 may perform matching on the basis of the transmission/reception message signals and change the DB and the RDB so as to transfer vehicle speed information of a cluster or the like, thereby maintaining compatibility.

[0061] Through the above process, the CCU 100 according to one embodiment of the present invention may transmit the finally adjusted DB to each controller and allow each controller to activate communication on the basis of the DB in the latest state. In this case, since a signal of the message or the DB version, which is received by the controller, may be varied, the CCU 100 checks whether a function of the controller is operated on the basis of received information. In addition, when a problem does not occur in the function of the controller, the controller is reactivated to provide overall functions or a limited function. In addition, the CCU 100 performs a message transfer function between networks on the basis of the adjusted RDB.

[0062] On the other hand, when the predetermined module is changed and thus required essential functions are not activated, the CCU 100 may generate a DTC to check validity of the performed module change process.

[0063] Meanwhile, in the above description, operations S110 to S340 may be further divided into a larger number of operations or combined into a smaller number of operations according to the embodiments of the present invention. In addition, some operations may be omitted, when necessary, and the order between operations may be changed. In addition, although there are omitted contents, the content of FIGS. 2A to 4 may also be applied to the content of FIG. 5.

[0064] Hereinafter, a CCU (hereinafter, referred to as the CCU 100) capable of configuring a dynamic network in a purpose-built vehicle according to one embodiment of the present invention will be described with reference to FIG. 5.

[0065] FIG. 5 is a diagram for describing the CCU 100 according to one embodiment of the present invention.

[0066] The CCU 100 according to one embodiment of the present invention includes a communication module 110, a memory 120, and a processor 130.

[0067] The communication module 110 is connected to a plurality of controllers through a predetermined communication network and performs communication.

[0068] The memory 120 stores a program for dynamically configuring a network of controllers which are connected as a predetermined module in the purpose-built vehicle is changed, and the processor 130 executes the program stored in the memory 120.

[0069] As the predetermined module is changed, the processor 130 broadcasts a request for a response of a diagnostic message ID to all controllers through the communication module 110 and receives the response of the diagnostic message ID from each of the controllers in response to the broadcasting.

[0070] Then, the processor 130 checks a controller connected to each network on the basis of the received diagnostic message ID, requests attribute information including a transmission message, a reception message, message type information, a message signal configuration, and a DB version of the controller on the basis of the diagnostic message ID, collects responses corresponding to the attribute information request to generate a DB, and reactivate each controller on the basis of the generated DB to configure a dynamic network.

[0071] The above-described method of configuring a dynamic network in the CCU 100 of a purpose-built vehicle according to one embodiment of the present invention may be implemented using a program (or application) to be executed in combination with a computer, which is hardware, and may be stored in a medium.

[0072] In order for the computer to read the program and execute the method implemented using the program, the above-described may include code coded using computer languages, such as C, C++, JAVA, Ruby, and a machine language, which may be read by a processor (central processing unit (CPU)) of the computer through a device interface of the computer. The code may include functional code related to a function defining required functions executing the method and include control code related to an execution procedure, which are required for the processor of the computer to execute the required functions according to a predetermined procedure. In addition, the code may further include additional information required for the processor of the computer to execute the required functions or include code related to memory reference in which media refers to which a location (address) in an internal or external memory of the computer. In addition, when the processor of the computer needs to communicate with any other computers or servers in remote locations so as to execute the required functions, the code may further include communication-related code for how to communicate with any other remote computers or servers using a communication module of the computer and communication-related code for which information or media to transmit/receive during communication.

[0073] The storage medium refers to a medium which stores data semi-permanently and is readable by a device instead of a medium which stores data for a short period of time, such as a register, a cache, or a memory. Specifically, examples of the storage medium include a read only memory (ROM), a random access memory (RAM), a compact disc (CD)-ROM, a magnetic tape, a floppy disk, and an optical data storage device, but the present invention is not limited thereto. That is, the program may be stored in various recording media of various servers to which the computer can access or in various recording media of the computer of a user. In addition, the storage medium may be implemented in a distributed manner in computer systems connected to a network, and a computer-readable code may be stored in a distributed manner.

[0074] In order to configure a purpose-built vehicle, it is essential to replace a hardware module suitable for the purpose. However, since all controllers and information are predetermined in a general vehicle network, it is difficult to exchange information between the controllers.

[0075] In accordance with the above-described embodiments of the present invention, a conceptual purpose-built vehicle can be actually implemented through a method of dynamically reconfiguring a network when the replacement of a hardware module occurs.

[0076] Since network reconfiguration occurs only in specific situations (module replacement, an end-of-line (EOL), and the like), when a method of configuring a dynamic network according to the present invention is applied to the existing mass-produced vehicle, there is an advantage in that all vehicle models can be mass-produced using a single type of a central communication unit (CCU). Therefore, it is possible to reduce a development cost for each vehicle model and a management cost due to a change of a part number.

[0077] In addition, when a controller is added through vehicle modification, it is currently not possible to connect the added controller to a vehicle network. That is, even when a multifunction camera (MFC) applied to a new vehicle is installed in a used vehicle and control unit (MEB) software is updated, an MFC function cannot be operated normally due to mismatch between a message identification (ID) and signal information.

[0078] In contrast, in accordance with the embodiments of the present invention, since a task of matching pieces of information in the network is performed, there is an advantage in that an update of a vehicle using a new controller is possible.

[0079] It should be noted that effects of the present invention are not limited to the above described effect, and other effects of the present invention not mentioned above can be clearly understood by those skilled in the art from the above description.

[0080] The above-described description of the present invention is intended only for an illustrative purpose. Therefore, it should be understood that the above-described embodiments are not restrictive but illustrative in all aspects. For example, each component described as a single form may be implemented in a distributed manner, and similarly,

components described as being distributed may also be implemented in a combined form.

Claims

1. A method of configuring , by a central communication unit (100) , a dynamic network in a purpose-built vehicle, the method comprising:

   broadcasting, to a plurality of controllers, a first request for a diagnostic message identification in response to a module change with respect to a purpose-built vehicle, wherein each controller is connected to one of a plurality of networks;
   receiving, from each of the controllers, a first response to the broadcasted first request, the first response including the diagnostic message identification;
   checking each controller based on the diagnostic message identification included in the received first response, wherein it is checked by the central communication unit (100) whether diagnostic message identifications of controllers are duplicate;
   based on the received diagnostic message identification, sending, to each controller, a second request for attribute information of the controller, the attribute information including a transmission message, a reception message, message type information, a message signal configuration, and a database version of the controller;
   receiving, from each of the controllers, a second response including the attribute information;
   generating a database based on the attribute information included in the second response from each controller;
   detecting a plurality of duplicate messages including one or more of the transmission messages and the reception messages of the controllers connected to the same network and having the duplicate diagnostic message identifications;
   comparing the message type information and the message signal configurations of the duplicated messages; and
   activating or removing each of the duplicate messages in or from the generated database based on a result of the comparing and a priority of each controller corresponding to each duplicated message;
   and
   reactivating each controller based on the generated database and configuring a dynamic network.

2. The method of claim 1, further comprising:

   detecting that a communication with at least one of the controllers has failed due to the diagnostic message identifications received from a group of the controllers being duplicates of each other; and
   causing the group of the controllers to respectively resend the second response with different delay times.

3. The method of claim 2, further comprising:

   in response to receiving the diagnostic message identification from each controller, checking classification information of each controller and identifying the controllers from which the duplicate diagnostic message identifications are received; and
   sending, to the group of the controllers, a third request to change the diagnostic message identification.

4. The method of claim 2, wherein:

   the group of the controllers comprises a first controller, and
   the method further comprising:

      detecting that the first controller is connected to an Ethernet; and
      excluding the first controller from causing the group of the controllers from resending the second response with the different delay times.

5. The method of claim 1, further comprising:

   extracting the attribute information from the generated database; and
   generating a routing database.

6. The method of claim 1, wherein activating or removing each of the duplicate messages comprises:

detecting that the message type information and the message signal configurations of the duplicated messages are identical to each other; and
removing one of the duplicate messages associated with the controller having a lower priority.

7. The method of claim 1, wherein activating or removing each of the duplicate comprises:

detecting that at least one of the message type information and the message signal configurations of the duplicated messages is different from the other; and
increasing a value of the diagnostic message identification of one of the controllers having a lower priority message identification.

8. The method of claim 7, wherein increasing of the value of the diagnostic message identification comprises:

detecting that the increased value of the message identification exceeds a predetermined threshold value; and
generating and adding a diagnostic trouble code to the diagnostic message identification.

9. The method of claim 1, further comprising:

matching a plurality of transmission/reception message signals between the controllers based on the generated database;
checking, based on a result of the matching, compatibility of each controller connected to the central communication unit (100) with respect to other controllers; and
adjusting the compatibility between the controllers determined to be incompatible with each other.

10. The method of claim 9, wherein:

checking the compatibility of each controller comprises determining that a compatibility problem is present with respect to the controllers when a plurality of locations of the transmission/reception message signals do not match, and
adjusting the compatibility between the controllers comprises adjusting the locations of the transmission/reception message signals of the controllers that do not match and maintaining the compatibility between the controllers.

11. The method of claim 9, wherein:

checking the compatibility of each controller comprises determining that a compatibility problem is present with respect to the controllers when a number of bits of the transmission/reception message signals do not match when the central communication unit (100) is not connected to an external network; and
adjusting the compatibility between the controllers comprises adjusting to maintain the compatibility between the controllers using the transmission messages and the reception messages with a smaller number of bits of the transmit/receive message signals of the controllers that do not match.

12. The method of claim 9, wherein checking the compatibility of each controller connected to the central communication unit (100) comprises checking the compatibility of the controller based on a compatibility summary table stored in the central communication unit (100) when the controller connected to the central communication unit (100) includes first version information different from second version information of the configured database.

13. The method of claim 9, wherein checking the compatibility of each controller connected to the central communication unit (100) comprises causing the central communication unit (100) to inquire a database management server and to check the compatibility when transmission/reception message signals that do not match are present in a result of the matching or the controller including first version information different from second version information of the database is present while the central communication unit (100) is connected to an external network.

14. The method of claim 9, wherein:

the controllers comprise first and second controllers, and
adjusting the compatibility between the controllers comprises replacing the first controller with the second controller based on a result of the matching, and adjusting and maintaining the compatibility when the first controller

connected to the central communication unit (100) before the module change is excluded from the module change.

15. A central communication unit (100) for configuring a dynamic network in a purpose-built vehicle, the central communication unit (100) comprising:

a processor (130); and
a computer-readable medium in communication with the processor (130) and storing instructions that, when executed by the processor (130), cause the processor to control the system to perform:

broadcasting, to a plurality of controllers, a first request for a diagnostic message identification in response to a module change with respect to a purpose-built vehicle, wherein each controller is connected to one of a plurality of networks;
receiving, from each of the controllers, a first response to the broadcasted request, the first response including the diagnostic message identification;
checking each controller based on the diagnostic message identification included in the first response, wherein it is checked by the central communication unit (100) whether diagnostic message identifications of controllers are the same;
based on the received diagnostic message identification, sending, to each controller, a second request for attribute information including a transmission message, a reception message, message type information, a message signal configuration, and a database version of the controller;
receiving, from each of the controllers, a second response including the attribute information;
generating a database based on the attribute information included in the second response from each controller;
detecting a plurality of duplicate messages including one or more of the transmission messages and the reception messages of the controllers connected to the same network and having the duplicate diagnostic message identifications;
comparing the message type information and the message signal configurations of the duplicated messages; and
activating or removing each of the duplicate messages in or from the generated database based on a result of the comparing and a priority of each controller corresponding to each duplicated message and reactivates each controller based on the generated database and configuring a dynamic network.

Patentansprüche

1. Verfahren zum Konfigurieren eines dynamischen Netzwerks in einem Spezialfahrzeug durch eine zentrale Kommunikationseinheit (100), wobei das Verfahren die folgenden Schritte aufweist:

Senden, an mehrere Controller, einer ersten Anforderung einer Diagnosenachrichtidentifikation in Reaktion auf einen Modulwechsel in Bezug auf ein Spezialfahrzeug, wobei jeder Controller mit einem von mehreren Netzwerken verbunden ist;
Empfangen, von jedem der Controller, einer ersten Antwort auf die erste gesendete Anforderung, wobei die erste Antwort die Diagnosenachrichtidentifikation aufweist;
Prüfen jedes Controllers basierend auf der in der empfangenen ersten Antwort erhaltenen Diagnosenachrichtidentifikation, wobei durch die zentrale Kommunikationseinheit (100) geprüft wird, ob Diagnosenachrichtidentifikationen von Controllern doppelt sind;
basierend auf der empfangenen Diagnosenachrichtidentifikation, Senden einer zweiten Anforderung von Attributinformationen des Controllers an jeden Controller, wobei die Attributinformationen eine Sendenachricht, eine Empfangsnachricht, Nachrichtentypinformationen, eine Nachrichtensignalkonfiguration, und eine Datenbankversion des Controllers aufweisen;
Empfangen einer zweiten Antwort von jedem der Controller, welche die Attributinformationen aufweist;
Erzeugen einer Datenbank basierend auf den in der zweiten Antwort von jedem Controller enthaltenen Attributinformationen;
Erkennen mehrerer doppelter Nachrichten, die eine oder mehr der Sendenachrichten und der Empfangsnachrichten der Controller umfassen, welche mit demselben Netzwerk verbunden sind und die doppelten Diagnosenachrichtidentifikationen aufweisen;
Vergleichen der Nachrichtentypinformationen und der Nachrichtensignalkonfigurationen der doppelten Nach-

richten; und
Aktivieren oder Entfernen jeder der doppelten Nachrichten in oder aus der erzeugten Datenbank basierend auf einem Ergebnis des Vergleichs und einer Priorität jedes, jeder doppelten Nachricht entsprechenden Controllers; und Reaktivieren jedes Controllers basierend auf der erzeugten Datenbank und Konfigurieren eines dynamischen Netzwerks.

2. Verfahren nach Anspruch 1, ferner mit den Schritten:

Erkennen, dass eine Kommunikation mit mindestens einem der Controller fehlgeschlagen ist, da die von einer Gruppe der Controller empfangenen Diagnosenachrichtidentifikationen Duplikate voneinander sind; und
Veranlassen der Gruppe von Controllern dazu, jeweils die zweite Antwort mit verschiedenen Verzögerungszeiten neu zu senden.

3. Verfahren nach Anspruch 2, ferner mit den Schritten:

in Reaktion auf das Empfangen der Diagnosenachrichtidentifikation von jedem Controller, Prüfen der Klassifikationsinformationen jedes Controllers und Identifizieren der Controller, von welchen die doppelten Diagnosenachrichtidentifikationen empfangen werden; und
Senden einer dritten Anforderung zum Ändern der Diagnosenachrichtidentifikation an die Gruppe der Controller.

4. Verfahren nach Anspruch 2, bei welchem:

die Gruppe von Controllern einen ersten Controller aufweist, und
das Verfahren ferner die folgenden Schritte aufweist:

Erkennen, dass der erste Controller mit einem Ethernet verbunden ist; und
Ausschließen des ersten Controllers davon, die Gruppe der Controller zu veranlassen, die zweite Antwort mit den verschiedenen Zeitverzögerungen erneut zu senden.

5. Verfahren nach Anspruch 1, ferner mit den Schritten:

Extrahieren der Attitüdeninformationen aus der erzeugten Datenbank; und
Erzeugen einer Routing-Datenbank.

6. Verfahren nach Anspruch 1, bei welchem das Aktivieren oder Entfernen jeder der doppelten Nachrichten die folgenden Schritte aufweist:

Erkennen, dass die Nachrichtentypinformationen und die Nachrichtensignalkonfigurationen der doppelten Nachrichten miteinander identisch sind; und
Entfernen einer der doppelten Nachrichten, die dem Controller mit niedrigerer Priorität zugeordnet ist.

7. Verfahren nach Anspruch 1, bei welchem das Aktivieren oder Entfernen jeder der doppelten Nachrichten die folgenden Schritte aufweist:

Erkennen, dass die Nachrichtentypinformationen und/oder die Nachrichtensignalkonfigurationen der doppelten Nachrichten von den anderen verschieden sind;
Erhöhen eines Werts der Diagnosenachrichtidentifikation eines der Controller mit einer Nachrichtenidentifikation geringerer Priorität.

8. Verfahren nach Anspruch 7, bei welchem das Erhöhen des Werts der Diagnosenachrichtidentifikation die folgenden Schritte aufweist:

Erkennen, dass der erhöhte Wert der Nachrichtenidentifikation einen vorbestimmten Schwellenwert übersteigt; und
Erzeugen und Hinzufügen eines Diagnosefehlercodes zu der Diagnosenachrichtidentifikation.

9. Verfahren nach Anspruch 1, ferner mit den Schritten:

Abgleichen mehrerer Sende-/Empfangsnachrichtensignale zwischen den Controllern basierend auf der erzeugten Datenbank;
Prüfen, basierend auf einem Ergebnis des Abgleichs, der Kompatibilität jedes mit der zentralen Kommunikationseinheit (100) verbundenen Controllers in Bezug auf andere Controller; und
Anpassen der Kompatibilität zwischen den als miteinander inkompatibel festgestellten Controllern.

10. Verfahren nach Anspruch 9, bei welchem:

das Prüfen der Kompatibilität jedes Controllers das Feststellen umfasst, dass ein Kompatibilitätsproblem in Bezug auf die Controller vorliegt, wenn mehrere Stellen der Sende-/Empfangssignale nicht übereinstimmen; und
das Anpassen der Kompatibilität zwischen den Controllern das Anpassen der Stellen der Sende-/Empfangssignale der Controller, die nicht übereinstimmen, und das Aufrechterhalten der Kompatibilität zwischen den Controllern umfasst.

11. Verfahren nach Anspruch 9, bei welchem:

das Prüfen der Kompatibilität jedes Controllers das Feststellen umfasst, dass ein Kompatibilitätsproblem in Bezug auf die Controller vorliegt, wenn eine Anzahl von Bits der Sende-/Empfangssignale nicht übereinstimmt, wenn die zentrale Kommunikationseinheit (100) nicht mit einem externen Netzwerk verbunden ist; und
das Anpassen der Kompatibilität zwischen den Controllern das Anpassen zum Aufrechterhalten der Kompatibilität zwischen den Controllern unter Verwendung der Sendenachrichten und der Empfangsnachrichten mit einer kleineren Anzahl von Bits der Sende-/Empfangssignale der Controller, die nicht übereinstimmen, umfasst.

12. Verfahren nach Anspruch 9, bei welchem das Prüfen der Kompatibilität jedes mit der zentralen Kommunikationseinheit (100) verbundenen Controllers das Prüfen der Kompatibilität des Controllers basierend auf einer Kompatibilitätsübersichtstabelle umfasst, welche in der zentralen Kommunikationseinheit (100) gespeichert ist, wenn der mit der zentralen Kommunikationseinheit (100) verbundene Controller erste Versionsinformationen aufweist, die von zweiten Versionsinformationen der konfigurierten Datenbank verschieden sind.

13. Verfahren nach Anspruch 9, bei welchem das Prüfen der Kompatibilität jedes mit der zentralen Kommunikationseinheit (100) verbundenen Controllers umfasst, die zentrale Kommunikationseinheit (100) zu veranlassen, einen Datenbankmanagementserver abzufragen und die Kompatibilität zu prüfen, wenn Sende-/Empfangssignale, die nicht übereinstimmen, in einem Abgleichergebnis vorhanden sind oder der Controller, welcher die ersten Versionsinformationen aufweist, welche von zweiten Versionsinformationen der Datenbank verschieden sind, vorliegt, während die zentrale Kommunikationseinheit (100) mit einem externen Netzwerk verbunden ist.

14. Verfahren nach Anspruch 9, bei welchem:

die Controller einen ersten und einen zweiten Controller aufweisen; und
das Anpassen der Kompatibilität zwischen den Controllern umfasst, den ersten Controller durch den zweiten Controller basierend auf einem Abgleichergebnis zu ersetzen, und die Kompatibilität anzupassen und aufrechtzuerhalten, wenn der vor dem Modulwechsel mit der zentralen Kommunikationseinheit (100) verbundene erste Controller von dem Modulwechsel ausgeschlossen wird.

15. Zentrale Kommunikationseinheit (100) zum Konfigurieren eines dynamischen Netzwerks in einem Spezialfahrzeug, wobei die zentrale Kommunikationseinheit (100) aufweist:

einen Prozessor (130); und
ein computerlesbares Medium, das in Verbindung mit dem Prozessor (130) steht und Befehle speichert, welche bei Ausführung durch den Prozessor (130) den Prozessor veranlassen, das System zur Ausführung der folgenden Schritte zu steuern:

Senden, an mehrere Controller, einer ersten Anforderung einer Diagnosenachrichtidentifikation in Reaktion auf einen Modulwechsel in Bezug auf ein Spezialfahrzeug, wobei jeder Controller mit einem von mehreren Netzwerken verbunden ist;
Empfangen, von jedem der Controller, einer ersten Antwort auf die erste gesendete Anforderung, wobei die erste Antwort die Diagnosenachrichtidentifikation aufweist;
Prüfen jedes Controllers basierend auf der in der empfangenen ersten Antwort erhaltenen Diagnosenach-

richtidentifikation, wobei durch die zentrale Kommunikationseinheit (100) geprüft wird, ob Diagnosenachrichtidentifikationen von Controllern doppelt sind;
basierend auf der empfangenen Diagnosenachrichtidentifikation, Senden einer zweiten Anforderung von Attributinformationen des Controllers an jeden Controller, wobei die Attributinformationen eine Sendenachricht, eine Empfangsnachricht, Nachrichtentypinformationen, eine Nachrichtensignalkonfiguration, und eine Datenbankversion des Controllers aufweisen;
Empfangen einer zweiten Antwort von jedem der Controller, welche die Attributinformationen aufweist;
Erzeugen einer Datenbank basierend auf den in der zweiten Antwort von jedem Controller enthaltenen Attributinformationen;
Erkennen mehrerer doppelter Nachrichten, die eine oder mehr der Sendenachrichten und der Empfangsnachrichten der Controller umfassen, welche mit demselben Netzwerk verbunden sind und die doppelten Diagnosenachrichtidentifikationen aufweisen;
Vergleichen der Nachrichtentypinformationen und der Nachrichtensignalkonfigurationen der doppelten Nachrichten; und
Aktivieren oder Entfernen jeder der doppelten Nachrichten in oder aus der erzeugten Datenbank basierend auf einem Ergebnis des Vergleichs und einer Priorität jedes, jeder doppelten Nachricht entsprechenden Controllers;
und Reaktivieren jedes Controllers basierend auf der erzeugten Datenbank und Konfigurieren eines dynamischen Netzwerks.

Revendications

1. Procédé de configuration, par une unité centrale de communication (100), d'un réseau dynamique dans un véhicule construit à cet effet, le procédé comprenant :

la diffusion, à une pluralité de contrôleurs, d'une première demande d'identification de message de diagnostic en réponse à un changement de module concernant un véhicule construit à cet effet, dans lequel chaque contrôleur est connecté à un d'une pluralité de réseaux ;
la réception, en provenance de chacun des contrôleurs, d'une première réponse à la première demande diffusée, la première réponse comprenant l'identification de message de diagnostic ;
la vérification de chaque contrôleur sur la base de l'identification de message de diagnostic comprise dans la première réponse reçue, dans lequel il est vérifié par l'unité centrale de communication (100) si les identifications de message de diagnostic des contrôleurs sont en double ;
sur la base de l'identification de message de diagnostic reçue, l'envoi, à chaque contrôleur, d'une deuxième demande d'informations d'attribut du contrôleur, les informations d'attribut comprenant un message de transmission, un message de réception, des informations de type de message, une configuration de signal de message et une version de base de données du contrôleur ;
la réception, en provenance de chacun des contrôleurs, d'une deuxième réponse comprenant les informations d'attribut ;
la génération d'une base de données sur la base des informations d'attribut comprises dans la deuxième réponse de chaque contrôleur ;
la détection d'une pluralité de messages en double comprenant un ou plusieurs parmi les messages de transmission et les messages de réception des contrôleurs connectés au même réseau et ayant les identifications de message de diagnostic en double ;
la comparaison des informations de type de message et des configurations de signal de message des messages dupliqués ; et
l'activation ou la suppression de chacun des messages en double dans ou à partir des bases de données générées sur la base d'un résultat de la comparaison et d'une priorité de chaque contrôleur correspondant à chaque message dupliqué ;
et
la réactivation de chaque contrôleur sur la base de base de données générée et la configuration d'un réseau dynamique.

2. Procédé selon la revendication 1, comprenant en outre :

la détection qu'une communication avec au moins un des contrôleurs a échoué parce que les identifications de message de diagnostic reçues d'un groupe des contrôleurs sont des doublons les unes des autres ; et

le fait d'amener le groupe des contrôleurs à renvoyer respectivement la deuxième réponse avec des temps de retard différents.

3. Procédé selon la revendication 2, comprenant en outre :

en réponse à la réception de l'identification de message de diagnostic de chaque contrôleur, la vérification d'informations de classification de chaque contrôleur et l'identification des contrôleurs dont les identifications de message de diagnostic en double sont reçues ; et
l'envoi au groupe des contrôleurs d'une troisième demande de changement de l'identification de message de diagnostic.

4. Procédé selon la revendication 2, dans lequel :

le groupe des contrôleurs comprend un premier contrôleur, et
le procédé comprenant en outre :

la détection que le premier contrôleur est connecté à un Ethernet ; et
l'exclusion du premier contrôleur dans le fait d'amener le groupe des contrôleurs à renvoyer la deuxième réponse avec des temps de retard différents.

5. Procédé selon la revendication 1, comprenant en outre :

l'extraction des informations d'attribut de la base de données générée ; et
la génération d'une base de données de routage.

6. Procédé selon la revendication 1, dans lequel l'activation ou la suppression de chacun des messages en double comprend :

la détection que les informations de type de message et les configurations de signal de message des messages dupliqués sont identiques les unes aux autres ; et
la suppression de l'un des messages en double associés au contrôleur ayant une priorité inférieure.

7. Procédé selon la revendication 1, dans lequel l'activation ou la suppression de chacun des doublons comprend :

la détection qu'au moins une des informations de type de message et des configurations de signal de message des messages dupliqués est différente de l'autre ; et
l'augmentation d'une valeur de l'identification de message de diagnostic de l'un des contrôleurs ayant une identification de message de priorité inférieure.

8. Procédé selon la revendication 7, dans lequel l'augmentation de la valeur de l'identification de message de diagnostic comprend :

la détection que la valeur augmentée de l'identification de message dépasse une valeur seuil prédéterminée ; et
la génération et l'ajout d'un code d'anomalie de diagnostic à l'identification de message de diagnostic.

9. Procédé selon la revendication 1, comprenant en outre :

la concordance d'une pluralité de signaux de message de transmission/réception entre les contrôleurs sur la base de la base de données générée ;
la vérification, sur la base d'un résultat de la concordance, de la compatibilité de chaque contrôleur connecté à l'unité centrale de communication (100) par rapport aux autres contrôleurs ; et
l'ajustement de la compatibilité entre les contrôleurs déterminés comme étant incompatibles les uns avec les autres.

10. Procédé selon la revendication 9, dans lequel :

la vérification de la compatibilité de chaque contrôleur comprend la détermination qu'un problème de compatibilité est présent en ce qui concerne les contrôleurs lorsqu'une pluralité d'emplacements des signaux de

message de transmission/réception ne concordent pas, et
l'ajustement de la compatibilité entre les contrôleurs comprend l'ajustement des emplacements des signaux de message de transmission/réception des contrôleurs qui ne concordent pas et le maintien de la compatibilité entre les contrôleurs.

11. Procédé selon la revendication 9, dans lequel :

la vérification de la compatibilité de chaque contrôleur comprend la détermination qu'un problème de compatibilité est présent en ce qui concerne les contrôleurs lorsqu'un certain nombre de bits des signaux de message de transmission/réception ne concordent pas lorsque l'unité centrale de communication (100) n'est pas connectée à un réseau extérieur ; et
l'ajustement de la compatibilité entre les contrôleurs comprend l'ajustement pour maintenir la compatibilité entre les contrôleurs en utilisant les messages de transmission et les messages de réception avec un plus petit nombre de bits des signaux de message de transmission/réception des contrôleurs qui ne concordent pas.

12. Procédé selon la revendication 9, dans lequel la vérification de la compatibilité de chaque contrôleur connecté à l'unité centrale de communication (100) comprend la vérification de la compatibilité du contrôleur sur la base d'un tableau récapitulatif de compatibilité stocké dans l'unité centrale de communication (100) lorsque le contrôleur connecté à l'unité centrale de communication (100) comprend des informations de première version différentes des informations de deuxième version de la base de données configurée.

13. Procédé selon la revendication 9, dans lequel la vérification de la compatibilité de chaque contrôleur connecté à l'unité centrale de communication (100) comprend le fait d'amener l'unité centrale de communication (100) à interroger un serveur de gestion de base de données et à vérifier la compatibilité lorsque des signaux de message de transmission/réception qui ne concordent pas sont présents dans un résultat de la concordance ou que le contrôleur comprenant des informations de première version différentes des informations de deuxième version de la base de données est présent alors que l'unité centrale de communication (100) est connectée à un réseau extérieur.

14. Procédé selon la revendication 9, dans lequel :

les contrôleurs comprennent des premier et deuxième contrôleurs, et
l'ajustement de la compatibilité entre les contrôleurs comprend le remplacement du premier contrôleur par le deuxième contrôleur sur la base d'un résultat de la concordance, et l'ajustement et le maintien de la compatibilité lorsque le premier contrôleur connecté à l'unité centrale de communication (100) avant le changement de module est exclu du changement de module.

15. Unité centrale de communication (100) pour configurer un réseau dynamique dans un véhicule construit à cet effet, l'unité centrale de communication (100) comprenant :

un processeur (130) ; et
un support lisible par ordinateur en communication avec le processeur (130) et stockant des instructions qui, lorsqu'elles sont exécutées par le processeur (130), amènent le processeur à commander le système pour effectuer :

la diffusion, à une pluralité de contrôleurs, d'une première demande d'identification de message de diagnostic en réponse à un changement de module concernant un véhicule construit à cet effet, chaque contrôleur étant connecté à un d'une pluralité de réseaux ;
la réception, de chacun des contrôleurs, d'une première réponse à la demande diffusée, la première réponse comprenant l'identification de message de diagnostic ;
la vérification de chaque contrôleur sur la base de l'identification de message de diagnostic comprise dans la première réponse, dans laquelle il est vérifié par l'unité centrale de communication (100) si des identifications de message de diagnostic de contrôleurs sont les mêmes ;
sur la base de l'identification de message de diagnostic reçue, l'envoi, à chaque contrôleur, d'une deuxième demande d'informations d'attribut comprenant un message de transmission, un message de réception, des informations de type de message, une configuration de signal de message et une version de base de données du contrôleur ;
la réception, de chacun des contrôleurs, d'une deuxième réponse comprenant les informations d'attribut ;
la génération d'une base de données sur la base des informations d'attribut comprises dans la deuxième

réponse de chaque contrôleur ;
la détection d'une pluralité de messages en double comprenant un ou plusieurs parmi les messages de transmission et les messages de réception des contrôleurs connectés au même réseau et ayant les identifications de message de diagnostic en double ;
la comparaison des informations de type de message et des configurations de signal de message des messages dupliqués ; et
l'activation ou la suppression de chacun des messages en double dans ou à partir de la base de données générée sur la base d'un résultat de la comparaison et d'une priorité de chaque contrôleur correspondant à chaque message dupliqué, et
la réactivation de chaque contrôleur sur la base de la base de données générée et la configuration d'un réseau dynamique.

FIG. 1

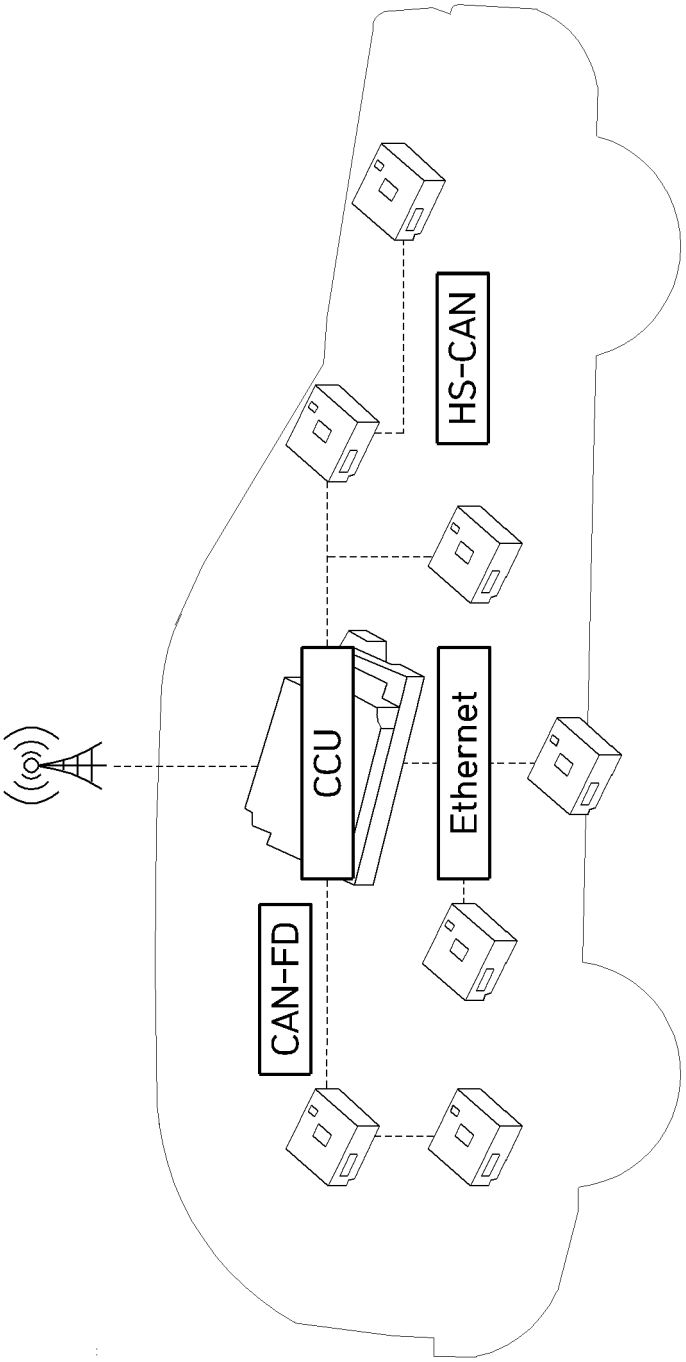


FIG. 2A

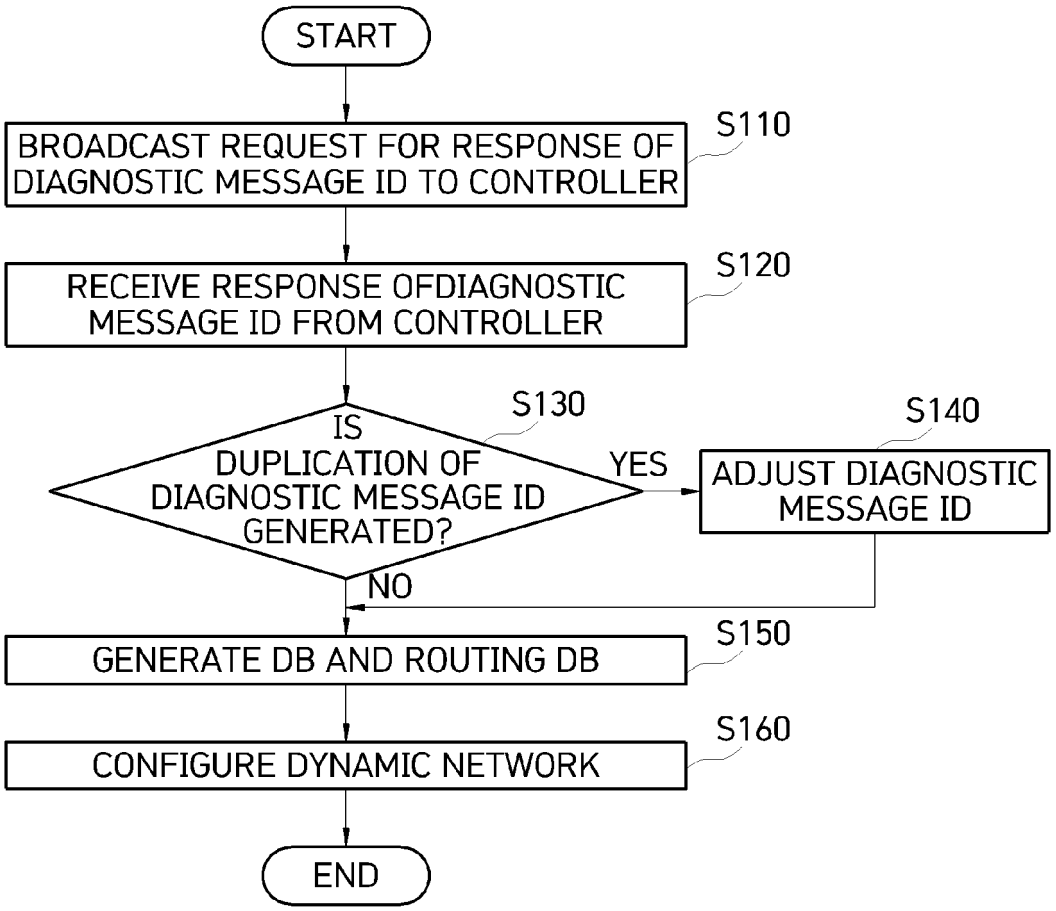

START
BROADCAST REQUEST FOR RESPONSE OF DIAGNOSTIC MESSAGE ID TO CONTROLLER
S110
RECEIVE RESPONSE OFDIAGNOSTIC MESSAGE ID FROM CONTROLLER
S120
IS DUPLICATION OF DIAGNOSTIC MESSAGE ID GENERATED?
S130
YES
ADJUST DIAGNOSTIC MESSAGE ID
S140
NO
GENERATE DB AND ROUTING DB
S150
CONFIGURE DYNAMIC NETWORK
S160
END

FIG. 2B

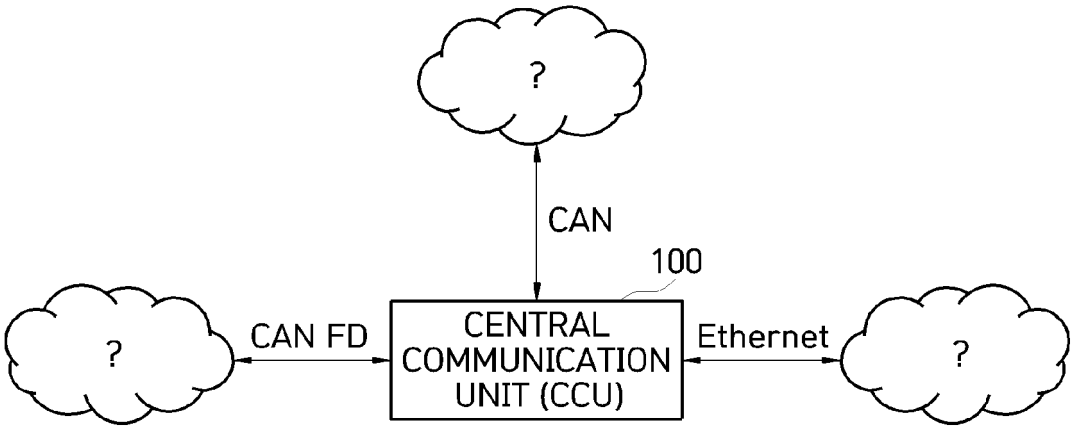

?
CAN
100
?
CAN FD
CENTRAL COMMUNICATION UNIT (CCU)
Ethernet
?

FIG. 2C

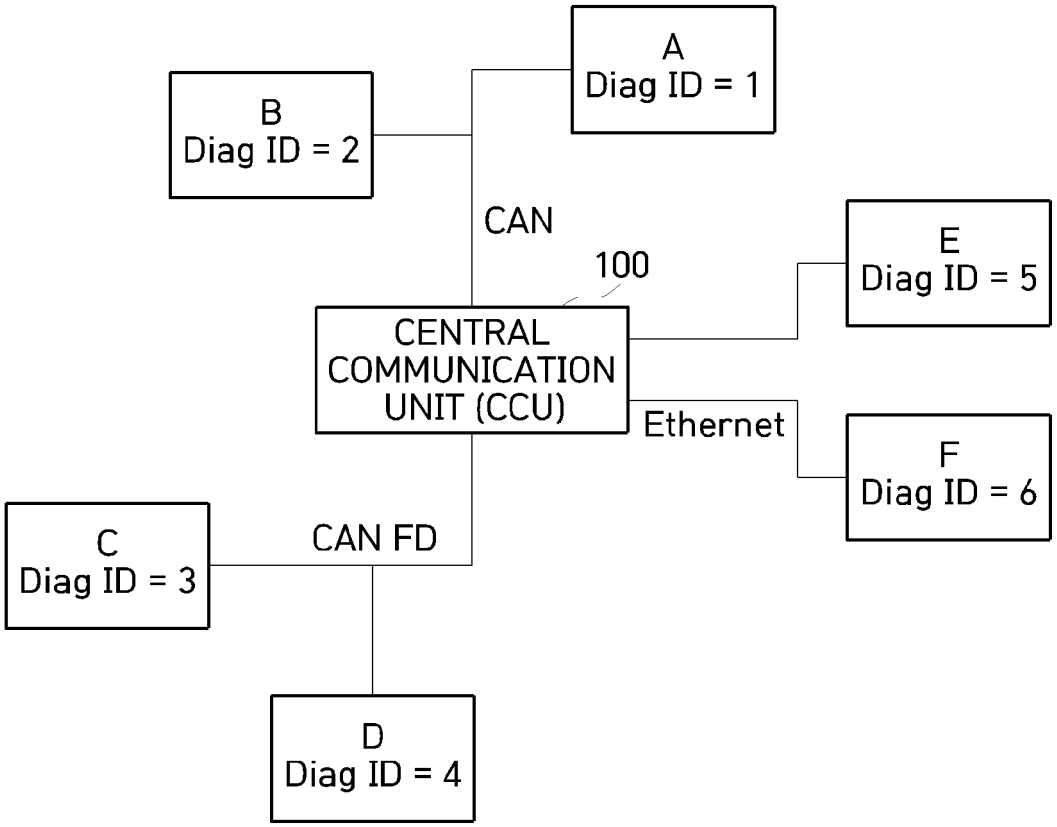

A
Diag ID = 1
B
Diag ID = 2
CAN
100
E
Diag ID = 5
CENTRAL
COMMUNICATION
UNIT (CCU)
Ethernet
F
Diag ID = 6
C
Diag ID = 3
CAN FD
D
Diag ID = 4

FIG. 2D

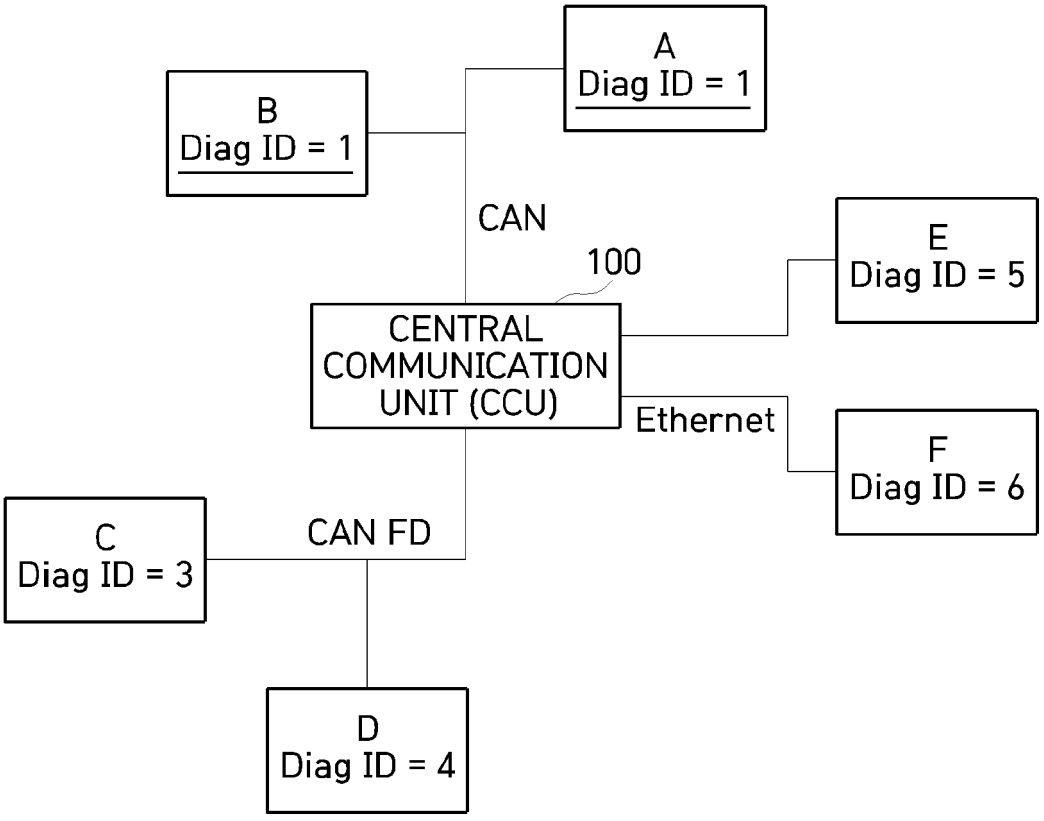

A
Diag ID = 1
B
Diag ID = 1
CAN
100
E
Diag ID = 5
CENTRAL
COMMUNICATION
UNIT (CCU)
Ethernet
F
Diag ID = 6
C
Diag ID = 3
CAN FD
D
Diag ID = 4

FIG. 2E

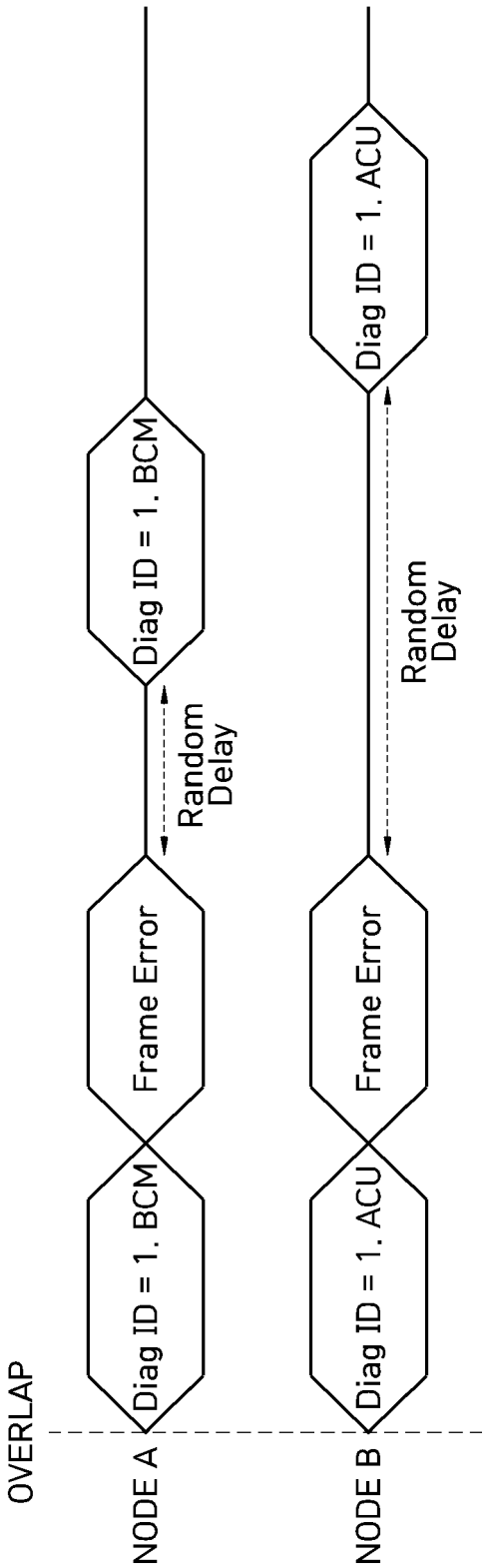

OVERLAP
NODE A
NODE B
Diag ID = 1. BCM
Frame Error
Random Delay
Diag ID = 1. BCM
Diag ID = 1. ACU
Frame Error
Random Delay
Diag ID = 1. ACU

FIG. 2F

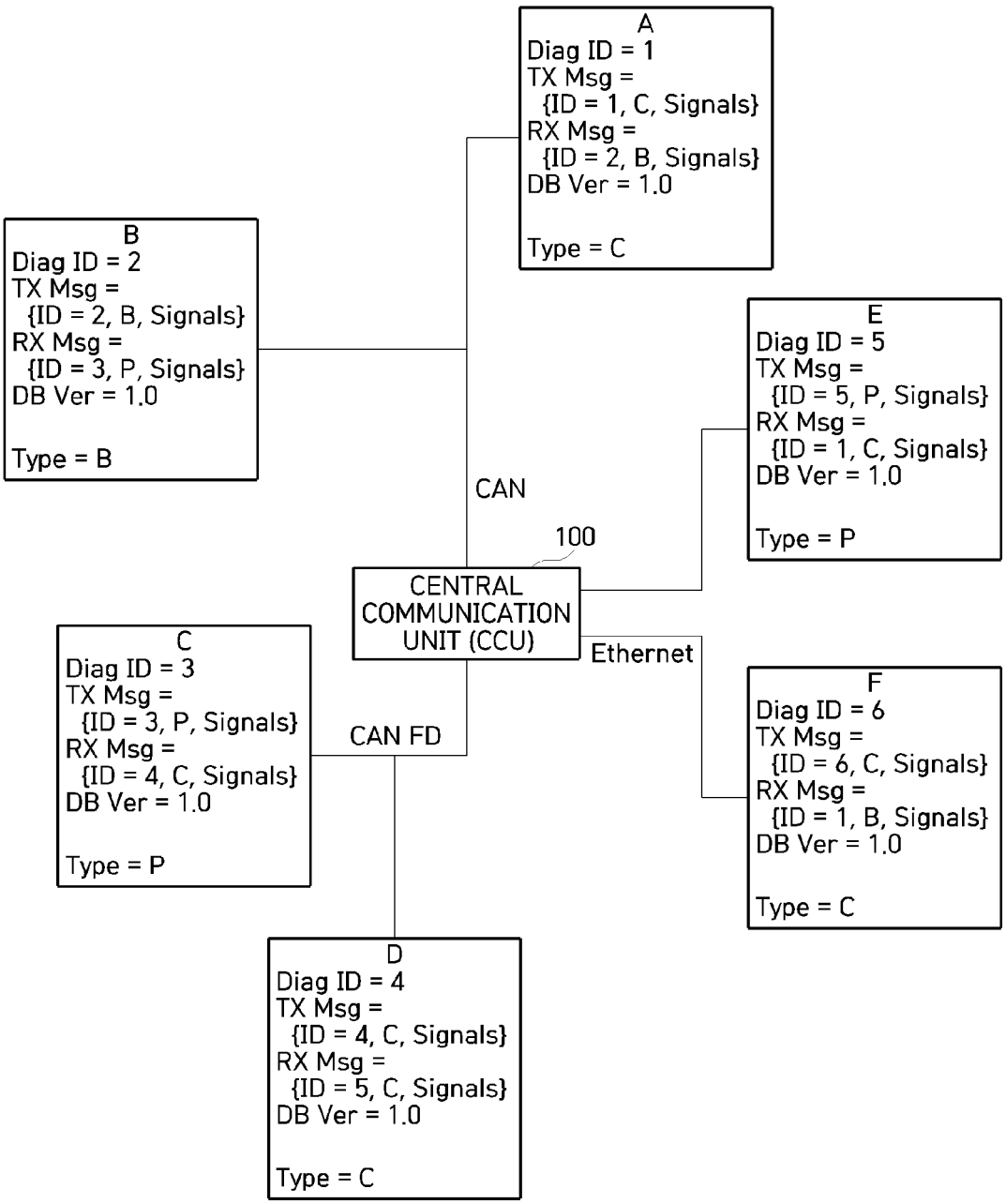

A
Diag ID = 1
TX Msg =
{ID = 1, C, Signals}
RX Msg =
{ID = 2, B, Signals}
DB Ver = 1.0
Type = C
B
Diag ID = 2
TX Msg =
{ID = 2, B, Signals}
RX Msg =
{ID = 3, P, Signals}
DB Ver = 1.0
Type = B
E
Diag ID = 5
TX Msg =
{ID = 5, P, Signals}
RX Msg =
{ID = 1, C, Signals}
DB Ver = 1.0
Type = P
CAN
100
CENTRAL COMMUNICATION UNIT (CCU)
Ethernet
C
Diag ID = 3
TX Msg =
{ID = 3, P, Signals}
RX Msg =
{ID = 4, C, Signals}
DB Ver = 1.0
Type = P
CAN FD
F
Diag ID = 6
TX Msg =
{ID = 6, C, Signals}
RX Msg =
{ID = 1, B, Signals}
DB Ver = 1.0
Type = C
D
Diag ID = 4
TX Msg =
{ID = 4, C, Signals}
RX Msg =
{ID = 5, C, Signals}
DB Ver = 1.0
Type = C

FIG. 3A

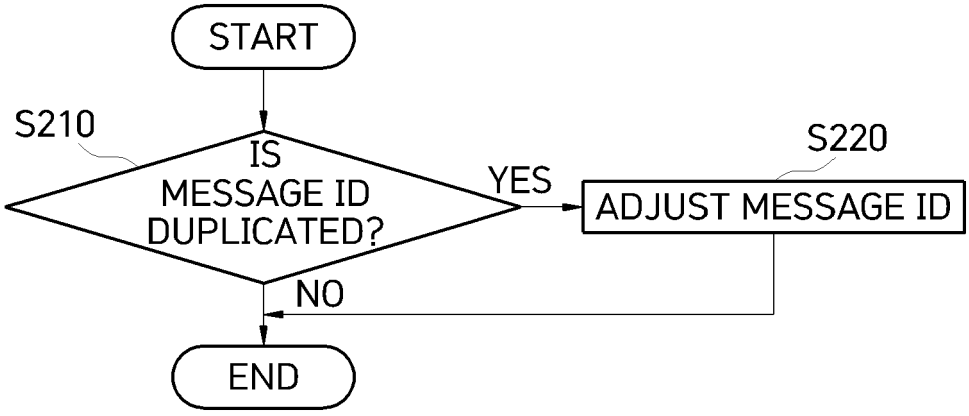

START
S210
IS MESSAGE ID DUPLICATED?
YES
S220
ADJUST MESSAGE ID
NO
END

FIG. 3B

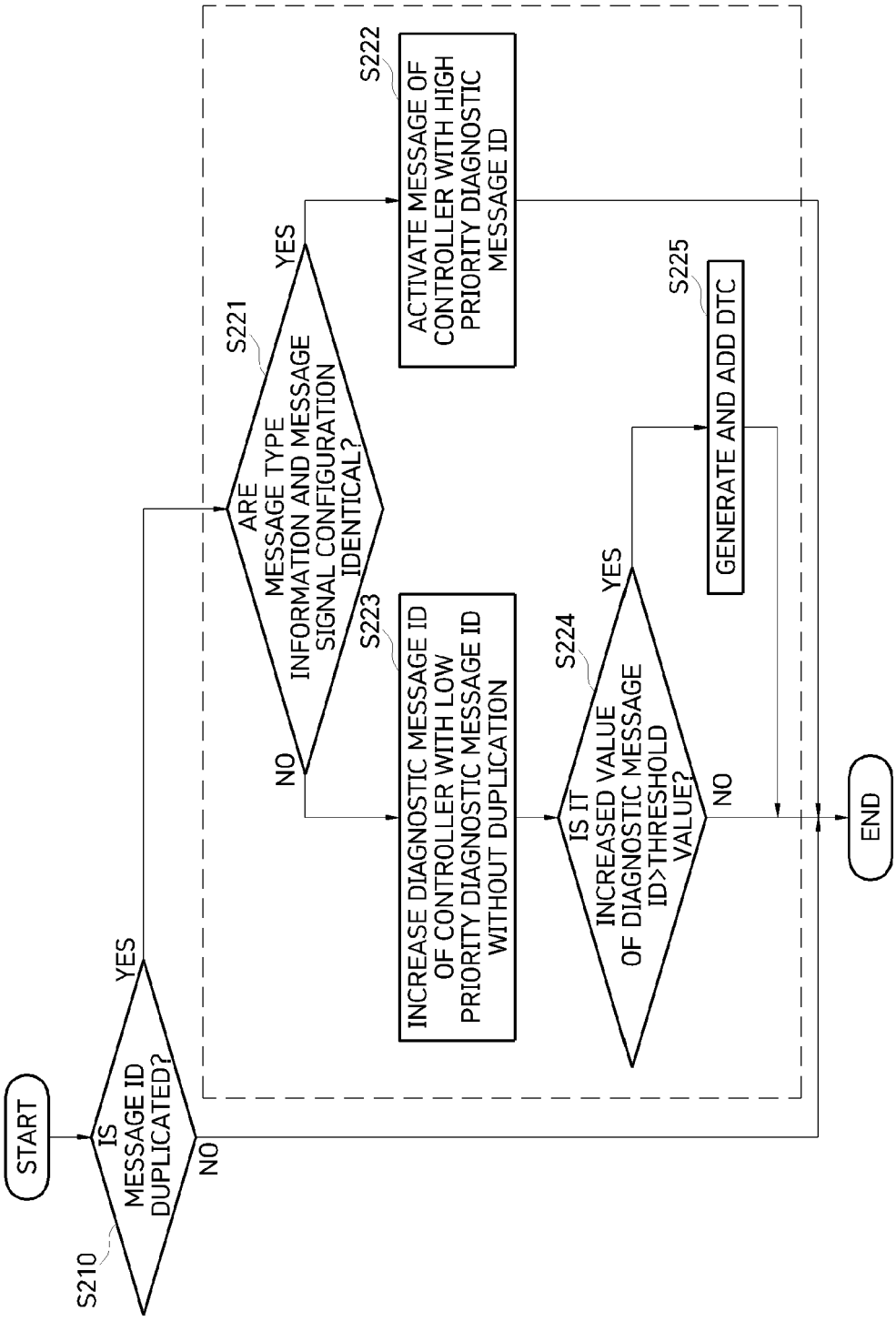

START
S210
IS MESSAGE ID DUPLICATED?
YES
NO
S221
ARE MESSAGE TYPE INFORMATION AND MESSAGE SIGNAL CONFIGURATION IDENTICAL?
YES
NO
S222
ACTIVATE MESSAGE OF CONTROLLER WITH HIGH PRIORITY DIAGNOSTIC MESSAGE ID
S223
INCREASE DIAGNOSTIC MESSAGE ID OF CONTROLLER WITH LOW PRIORITY DIAGNOSTIC MESSAGE ID WITHOUT DUPLICATION
S224
IS IT INCREASED VALUE OF DIAGNOSTIC MESSAGE ID>THRESHOLD VALUE?
YES
NO
S225
GENERATE AND ADD DTC
END

FIG. 4

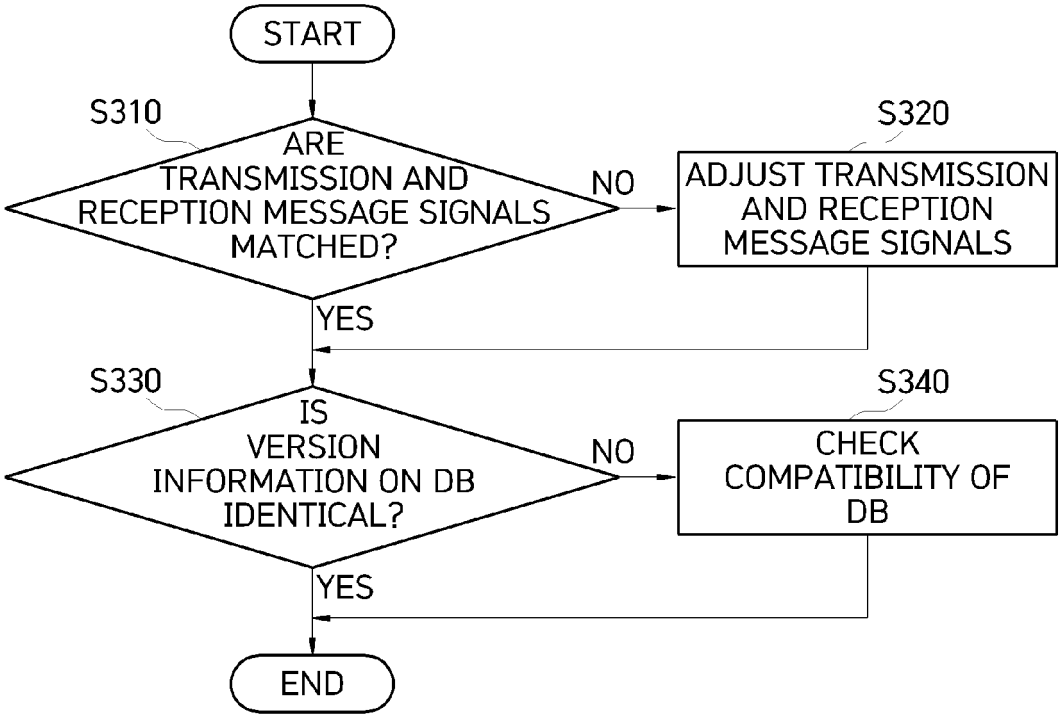
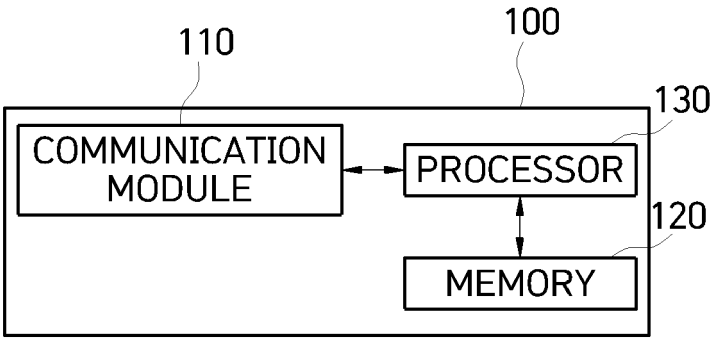

START
S310
ARE TRANSMISSION AND RECEPTION MESSAGE SIGNALS MATCHED?
NO
S320
ADJUST TRANSMISSION AND RECEPTION MESSAGE SIGNALS
YES
S330
IS VERSION INFORMATION ON DB IDENTICAL?
NO
S340
CHECK COMPATIBILITY OF DB
YES
END

FIG. 5


110
100
130
COMMUNICATION MODULE
PROCESSOR
120
MEMORY

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- KR 1020210027682 **[0001]**
- US 2010256860 A1 **[0010]**