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(54) **VEHICLE NETWORK SYSTEM AND MESSAGE TRANSMISSION AND RECEPTION METHOD THEREOF**

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H04L 9/00 (2022.01)
H04L 12/40 (2006.01)

(52) **U.S. Cl.**
CPC ***H04L 63/126*** (2013.01); ***H04L 12/40*** (2013.01); ***H04L 63/0876*** (2013.01); ***H04L 63/1441*** (2013.01); *H04L 2012/40215* (2013.01); *H04L 2012/40273* (2013.01)

(58) **Field of Classification Search**
CPC ... H04L 63/126; H04L 12/40; H04L 63/0876; H04L 63/1441; H04L 2012/40215; H04L 2012/40273; H04L 63/123; H04L 12/40039; H04L 9/00
See application file for complete search history.

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(57) **ABSTRACT**

A message transmission and reception method includes determining whether a message identifier (ID) of an encoded message exists in a blocking table for blocking messages when receiving the encoded message from a first controller, and transmitting the encoded message to the second controller when the message ID of the encoded message does not exist in the blocking table.

18 Claims, 3 Drawing Sheets

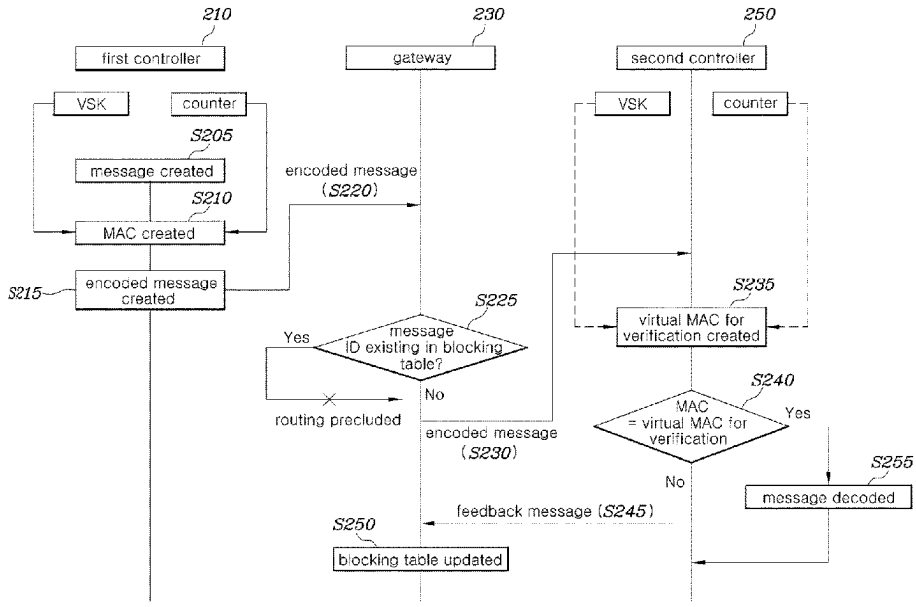

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FIG. 1

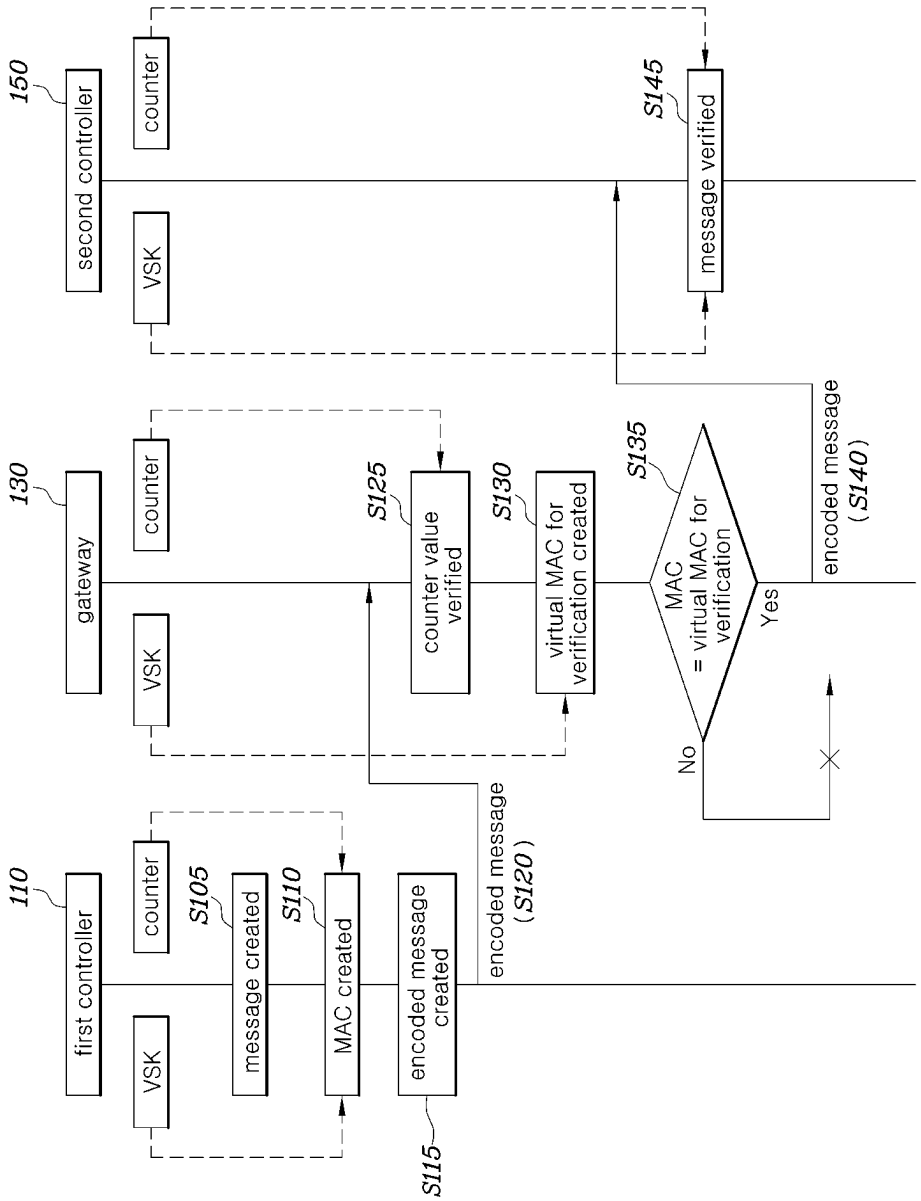

150
second controller
counter
VSK
S145
message verified
130
gateway
counter
VSK
S125
counter value verified
S130
virtual MAC for verification created
S135
MAC = virtual MAC for verification
Yes
No
encoded message (S140)
110
first controller
counter
VSK
S105
message created
S110
MAC created
encoded message created
S115
encoded message (S120)

FIG. 2

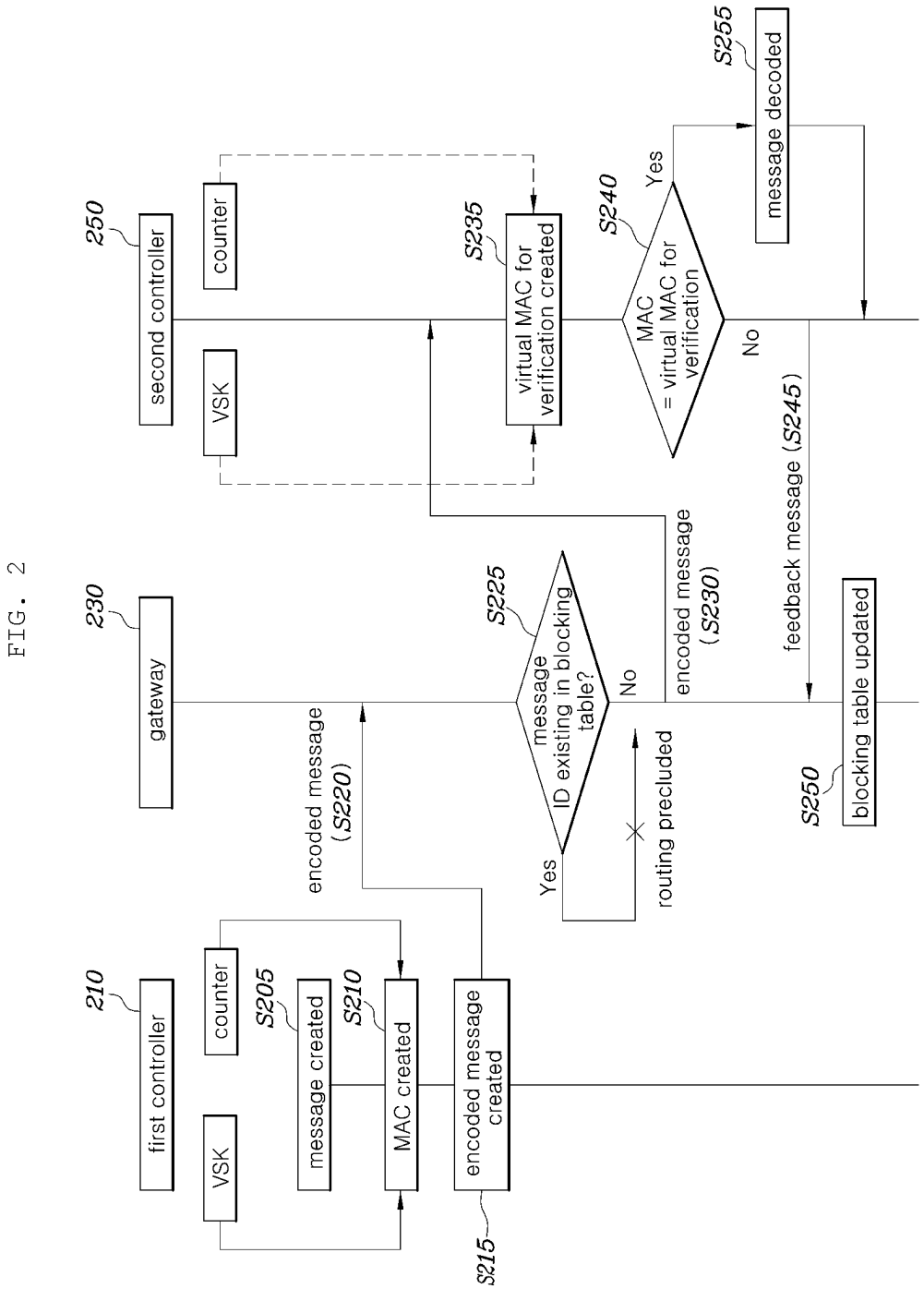
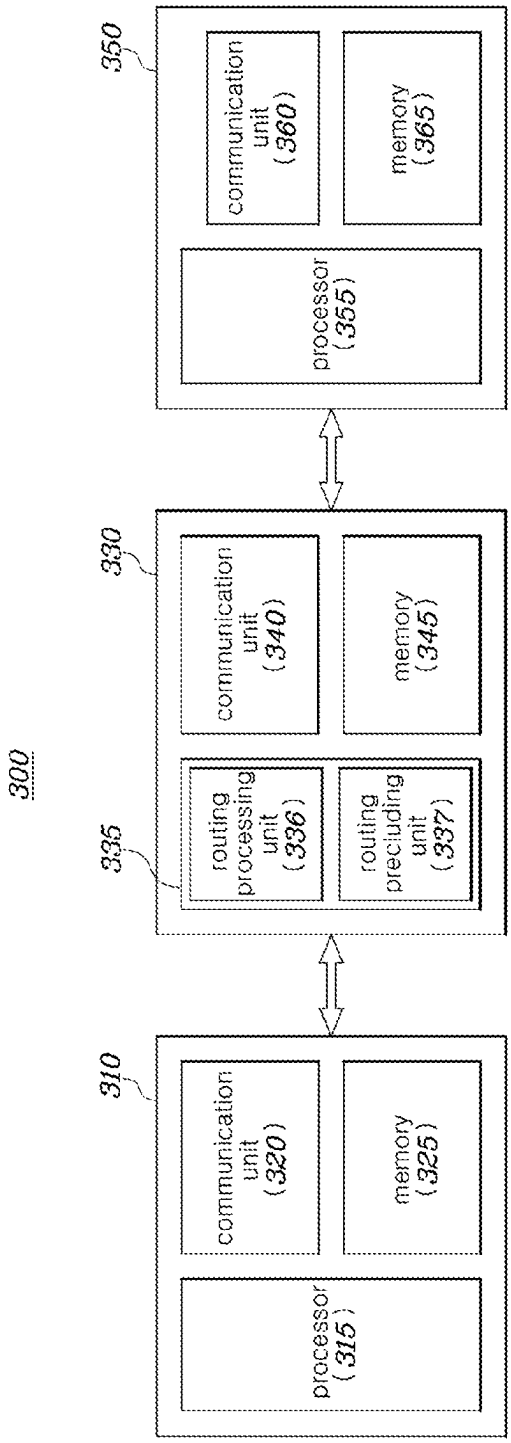

210
first controller
counter
VSK
S205
message created
S210
MAC created
encoded message created
S215
encoded message (S220)
230
gateway
S225
message ID existing in blocking table?
Yes
routing precluded
No
encoded message (S230)
250
second controller
counter
VSK
S235
virtual MAC for verification created
S240
MAC = virtual MAC for verification
Yes
message decoded
S255
No
feedback message (S245)
S250
blocking table updated

FIG. 3


300
310
communication unit (320)
memory (325)
processor (315)
335
routing processing unit (336)
routing precluding unit (337)
330
communication unit (340)
memory (345)
350
communication unit (360)
memory (365)
processor (355)

VEHICLE NETWORK SYSTEM AND MESSAGE TRANSMISSION AND RECEPTION METHOD THEREOF

CROSS REFERENCE TO RELATED APPLICATION

The present application claims priority to Korean Patent Application No. 10-2023-0054692, filed Apr. 26, 2023, the entire contents of which are incorporated herein for all purposes by this reference.

TECHNICAL FIELD

The present disclosure relates to a vehicle network, and, more particularly, to a vehicle network system and a message transmission and reception method thereof.

BACKGROUND

A vehicle may include an electronic control unit and multimedia devices to manage driving and supplementary functions. However, as the number of these components grows, so does the potential security risk.

In particular, within the context of vehicles, an electronic control unit (ECU) is vulnerable to arbitrary operation, transmitting signals to the ECU via a Controller Area Network. This susceptibility stems from external hacking and similar threats, potentially exposing vehicles and drivers to severe risks and accidents.

Consequently, the exploration of implementing an Intrusion Detection System (IDS) as an initial IT security measure within vehicle gateways is underway. This system involves application of a Message Authentication Code (MAC) to certain messages for the purpose of verifying message integrity. This is not limited to Integrated Data Processing (IDP) of a central processing type, each controller adopts this approach.

When a manipulated or falsified message reaches a controller, the controller can reject the altered message by cross-referencing the MAC value. However, since a message subjected to MAC authentication is not scrutinized at a gateway terminal, this poses the issue that a manipulated message can be received and processed intact, unless the receiving controller possesses MAC verification capabilities.

Addressing this concern, a solution involves embedding a Vehicle Shared Key (VSK) within both individual controller and gateways. This approach entails evaluating integrity by employing the VSK to compute a MAC for messages exclusively designated for MAC verification at the gateway. Consequently, messages failing the verification process are blocked from being routed further.

However, conducting integrity verification across an extensive volume of messages transmitted and received at across numerous domains could potentially exert a negative impact, especially as the number controllers within vehicles experiences rapid growth.

Thus, within the scope of the present disclosure, there arises a necessity for a technology capable of minimizing gateway routing latency while concurrently preventing the routing of counterfeit messages. This could be achieved, for instance, by transmitting feedback from a controller to the gateway.

SUMMARY

The present disclosure is directed to a vehicle network system and a message transmission and reception method thereof, the system and method being able to minimize routing latency of a gateway and preclude routing for forged messages by transmitting feedback to the gateway from a controller.

The present disclosure is also directed to a vehicle network system and a message transmission and reception method thereof, the system and method being able to quickly filter out forged messages even without directly performing integrity verification at a gateway.

According to one aspect, a message transmission and reception method that is performed at a gateway that receives a message from a first controller and transmits the message to a second controller in a vehicle network includes: determining whether a message identifier (ID) of an encoded message exists in a blocking table for blocking messages when receiving the encoded message from the first controller; and transmitting the encoded message to the second controller when the message ID of the encoded message does not exist in the blocking table.

The message transmission and reception method may further include: receiving a feedback message related to the encoded message from the second controller; and updating the blocking table on the basis of the feedback message.

The blocking table may include message identifier (ID) and state fields.

When the state filed has a value of 'Block' and the identifier (ID) of the encoded message coincides with an ID indicated by the message ID field, the encoded message may be blocked without being routed to the second controller.

The blocking table may be stored only during a current driving cycle of a vehicle and may be reset when the current driving cycle is ended or a next driving cycle is started.

The feedback message may include at least one or more of a field indicating that the feedback message is a verification feedback message, a field indicating an identifier (ID) of the encoded message, a field including a flag for the result of verifying the encoded message, or a field including a Message Authentication Code (MAC) value for the feedback message, or a combination thereof.

The feedback message may have a size of 12 bytes, the field indicating that the feedback message is a verification feedback message may have a size of 1 byte, the field indicating an ID of the encoded message may have a size of 2 bytes, the field including a flag for the result of verifying the encoded message may have a size of 1 byte, and the field including a MAC value for the feedback message may have a size of 8 bytes.

When the field indicating that the feedback message is a verification feedback message has a value of '11', the field may indicate that the feedback message is a verification feedback message.

The field indicating an ID of the encoded message may include ID information for a message that has failed in verification as the result of verification by the second controller.

The field including a flag for the result of verifying the encoded message may have a value of 'FF' or '00', the 'FF' may indicate that the encoded message has failed in verification as the result of normally verifying the encoded message, and the '00' may indicate that an error has been generated during verifying the encoded message.

Meanwhile, a gateway that receives a message from a first controller and transmits the message to a second controller in a vehicle network includes: a communication unit configured to receive an encoded message from the first controller and transmit the encoded message to the second controller when a message ID of the encoded message does

not exist in a blocking table; and a processor configured to determine whether the message ID of the encoded message exists in a blocking table for blocking messages.

The communication unit may receive a feedback message related to the encoded message from the second controller, and the processor may update the blocking table on the basis of the feedback message.

The blocking table may include message identifier (ID) and state fields.

When the state filed has a value of 'Block' and the identifier (ID) of the encoded message coincides with an ID indicated by the message ID field, the encoded message may be blocked without being routed to the second controller.

The blocking table may be stored only during a current driving cycle of a vehicle and may be reset when the current driving cycle is ended or a next driving cycle is started.

The feedback message may include at least one or more of a field indicating that the feedback message is a verification feedback message, a field indicating an identifier (ID) of the encoded message, a field including a flag for the result of verifying the encoded message, or a field including a Message Authentication Code (MAC) value for the feedback message, or a combination thereof.

The feedback message may have a size of 12 bytes, the field indicating that the feedback message is a verification feedback message may have a size of 1 byte, the field indicating an ID of the encoded message may have a size of 2 bytes, the field including a flag for the result of verifying the encoded message may have a size of 1 byte, and the field including a MAC value for the feedback message may have a size of 8 bytes.

When the field indicating that the feedback message is a verification feedback message has a value of '11', the field may indicate that the feedback message is a verification feedback message.

The field indicating an ID of the encoded message may include ID information for a message that has failed in verification as the result of verification by the second controller.

The field including a flag for the result of verifying the encoded message may have a value of 'FF' or '00', the 'FF' may indicate that the encoded message has failed in verification as the result of normally verifying the encoded message, and the '00' may indicate that an error has been generated during verifying the encoded message.

According to various implementations of the present disclosure described above, it is possible to quickly filter out forged messages without performing integrity verification at a gateway.

Further, it is possible to quickly filter out forged messages even without performing integrity verification at a gateway.

The effects of the present disclosure are not limited to the effects described above and other effects can be clearly understood by those skilled in the art from the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a diagram illustrating an example of a message transmission and reception method that is performed in a conventional vehicle network system.

FIG. **2** is diagram illustrating an example of a message transmission and reception method of a vehicle network system.

FIG. **3** is a block diagram schematically showing an example of the vehicle network system.

DETAILED DESCRIPTION

FIG. **1** shows an example of a message transmission and reception method that is performed in a conventional vehicle network system.

Referring to FIG. **1**, a first controller **110** creates a message to be transmitted to a second controller **150** (S**105**) and creates a Message Authentication Code (MAC) on the basis of a Vehicle Shared Key, which is a shared key that all of the electronic control units in a vehicle share, and a counter (S**110**).

Further, the first controller **110** creates an encoded message on the basis of the message created in step S**105** and the MAC created in step S**110** (S**115**) and transmits the created encoded message to a gateway **130** (S**120**).

In this case, the encoded message may be a payload control MAC message obtained by adding a counter value and the created MAC to a payload in the created message.

When receiving the encoded message from the first controller **110** (S**120**), the gateway **130** verifies the counter value in the encoded message (S**125**) and creates a virtual MAC for verification on the basis of the encoded message received from the first controller **110** and the Vehicle Shared Key (VSK) (S**130**). When the virtual MAC for verification is created, the gateway **130** determines whether the MAC in the encoded message received from the first controller **110** and the virtual MAC for verification coincide (S**135**), and transmits the encoded message to the second controller **150** when the MAC in the received encoded message and the virtual MAC for verification coincide (S**140**).

When receiving the encoded message from the gateway **130** (S**140**), the controller **150** verifies the received encoded message on the basis of the VSK and the counter (S**145**).

According to this message transmission and reception method, MAC verification is performed on all of encoded messages at a gateway terminal, and routing of messages is allowed only when MAC verification succeeds. Accordingly, an excessive load is applied to the gateway and high delay is added in proportion to the number of messages that are routed.

Hereafter, a message transmission and reception method according to the present disclosure that can maintain security while minimizing latency by solving the above defect is described.

FIG. **2** shows a message transmission and reception method of a vehicle network system.

In the specification, a first controller **210** may be defined as a message transmission controller and a second controller **250** may be defined as a message reception controller.

Further, a gateway **230** may be a Central Gateway (CGW).

Referring to FIG. **2**, a first controller **210** creates a message to be transmitted to a second controller **250** (S**205**) and creates a Message Authentication Code (MAC) on the basis of a Vehicle Shared Key, which is a shared key that all of the electronic control units in a vehicle share, and a counter (**210**).

In this case, the VSK is loaded in all of controllers as a key to be used for the purpose of common security in a vehicle and may be kept in a safe storage such as a Hardware Security Module (HSM) in a controller and a Trusted Execution Environment (TEE).

In this case, the counter may be defined as a resister or a storage device that is used to show the number of times of

occurrence of a specific event. When a next input signal or input pulse is received in an existing state, the counter may be stored as a new value by increasing an existing value by 1.

Further, the first controller **210** creates an encoded message on the basis of the message created in step S**205** and the MAC created in step S**210** (S**215**) and transmits the created encoded message to the gateway **230** (S**220**).

In this case, the encoded message may be a payload control MAC message obtained by adding a counter value and the MAC to a payload in the created message.

When receiving the encoded message from the first controller **210** (S**220**), the gateway **230** determines whether the message identifier (ID) of the received encoded message exists in a blocking table for blocking messages (S**225**), and transmits the encoded message to the second controller **250** when the message ID of the received encoded message does not exist in the blocking table (S**230**).

In this case, the gateway **230** can transmit the encoded message to the second controller **250** on the basis of a Routing DB (RDB).

In this case, the blocking table may have a data format shown in the following Table 1.

TABLE 1

Message ID(Msg ID)	State
0x2ed	Block
0x051	Block
0x5df	Block
. . .	

Referring to Table 1, the blocking table includes two fields and the two fields may include a Message ID (Msg ID) and a State.

In this case, when the state has a 'Block' value, the gateway **230** determines whether the Identified (ID) of the encoded message received from the first controller **210** coincide with an ID value indicated by the message ID field, and can block the encoded message without routing the encoded message to the second controller **250** when they coincide.

In this case, the blocking table is stored only during the current driving cycle of a vehicle and may be reset when the current driving cycle is ended or the next driving cycle is started.

When receiving the encoded message from the gateway **230** (S**230**), the second controller **250** creates a virtual MAC for verification on the basis of the encoded message received from the gateway **230** and the Vehicle Shared Key (VSK) (S**235**).

When the virtual MAC for verification is created, the second controller **250** determines whether the MAC in the encoded message received from the gateway **230** and the virtual MAC for verification coincide (S**240**), and decodes the encoded message when the MAC in the received encoded message and the virtual MAC for verification coincide (S**255**).

In this case, operation, etc. corresponding to the decoded message can be performed by the second controller **250**.

In this case, the operation corresponding to the message may be performed in an application installed in the second controller **250**.

Meanwhile, the second controller **250** transmits a feedback message to the gateway **230** when the MAC in the encoded message received from the gateway **230** and the virtual MAC for verification do not coincide as the result of determination in step S**240** (S**245**).

In this case, the feedback message may be a message related to the encoded message received from the gateway **230**.

In this case, the feedback message may have a data format shown in the following Table 2.

TABLE 2

Data Byte (A_Data byte)	Parameter Name	Byte Value
#1	Verification Feedback message	11_{16}
2	Verifying Failed message ID	02_{16}
#3		ED_{16}
4	Flag of verifying message [ ] = [Verification Fail: FF Verification Error: 00]	FF_{16}
5~#12	MAC of Feedback message [ ] = [	
	byte#1 (MSB)	XX_{16}
	byte#2	XX_{16}
	byte#3	XX_{16}
	byte#4	XX_{16}
	byte#5	XX_{16}
	byte#6	XX_{16}
	byte#7	XX_{16}
	byte#8	XX_{16}

Referring to FIG. **2**, a feedback message may be a message having a size of 12 bytes and may include at least one or more of a field indicating that the feedback message is a verification feedback message, a field indicating the identifier (ID) of the encoded message, a field including the flag for the result of verifying the encoded message, or a field including a Message Authentication Code (MAC) value for the feedback message, or a combination thereof.

In this case, the feedback message may include at least one of 'Verification Feedback message', 'Verifying Failed message ID', 'Flag of verifying message', or 'MAC of Feedback message', or a combination thereof.

The 'Verification Feedback message' that is the first field is composed of the first byte (#1) of a feedback message and may have a value of '1116'. The first field indicates that the feedback message is a verification feedback message.

The 'Verifying Failed message ID' that is the second field is composed of the second and third bytes (#2 and #3) of a feedback message and indicates the identifier (ID) of an encoded message. In this case, information about the message ID may be a CAN with flexible data rate (CAN-FD) message ID of 11 bits. However, the information about the message ID shows not a message ID for a feedback message, but a message ID for an encoded message that has been received from a gateway and verified by the second controller **250** and has failed in verification.

For example, when the ID of an encoded message that has failed in verification is 0x2ed, 2 bytes constituting the second field may be '02_{16}' and 'ED_{16}'.

Meanwhile, the 'Flag of verifying message' that is the third field is composed of the fourth (#4) byte of a feedback message and includes a flag related to the result of verifying an encoded message.

In this case, when verification fails as the result of normally verifying an encoded message by the second controller **250**, the third field has a value of 'FF_{16}'.

Meanwhile, when an error is generated while the second controller verifies an encoded message, the third field has a value of '00_{16}'.

In this case, when the third field in the feedback message has a value of '00_{16}', the gateway **230** does not specifically preclude routing. However, such a feedback message may be stored in a gateway and used later to examine whether a controller can perform MAC verification (read data).

Meanwhile, the 'MAC of Feedback message' that is the fourth field includes a MAC value using the VSK for a feedback message.

In this case, input for the MAC value may be entire plain text message data.

In this case, the fourth field may not include a message counter.

Meanwhile, the second controller **250** can verify whether the MAC in the encoded message and the virtual MAC for verification coincide over a predetermined number of times set in advance, and can transmit a feedback message to the gateway **230** when they do not coincide over the predetermined number of times.

For example, the second controller **250** can verify whether the MAC in the encoded message and the virtual MAC for verification coincide over three times, and can transmit a feedback message to the gateway **230** when they do not coincide over three times.

In this case, when the MAC in the encoded message and the virtual MAC for verification do not coincide, the controller **250** may create again a virtual MAC for verification and verify whether the virtual MAC for verification coincide with the MAC in the encoded message over three times.

The gateway **230** updates the blocking table (S**250**) when receiving a feedback message from the second controller (S**245**).

In this case, the blocking table may have the data format shown in Table 1.

When receiving an encoded message from the first controller **210**, the gateway **230**, on the basis of the updated blocking table, can determine whether the ID of the received encoded message exists in the blocking table, and can route the received encoded message to the second controller **250** or can block the received encoded message without of the routing on the basis determination result.

FIG. **3** is a block diagram schematically showing the vehicle network system.

Referring to FIG. **3**, a vehicle network system **300** includes a first controller **310**, a gateway **330**, and a second controller **350**.

The first controller **310** includes a processor **315**, a communication unit **320**, and a memory **325**.

The processor **310** may include an ASIC (application-specific integrated circuit), another chipset, a logic circuit, and/or a data processing unit. The processor **310** implements the signal transmission and reception method proposed in this specification. The processor **310**, in detail, creates an encoded message that is transmitted to a gateway.

In this case, the encoded message may be a payload control MAC message obtained by adding a counter value and a MAC to a payload in the created message.

The communication unit **320** is connected with the processor **315** and information transmits and/receives all of for implementing the signal transmission and reception method. For example, the communication unit **320** transmits an encoded message created by the processor **315** to the gateway **330**.

The memory **325** may include a ROM (read-only memory), a RAM (random access memory), a flash memory, a memory card, a storage medium, and/or another storage unit. The memory **325** stores information for implementing the message transmission and reception method. For example, the memory **325** stores at least one or more of a message, a VSK, a counter, a MAC value, or an encoded message, or a combination thereof.

The gateway **330** includes a processor **335**, a communication unit **340**, and a memory **345**.

The processor **335** may include an ASIC (application-specific integrated circuit), another chipset, a logic circuit, and/or a data processing unit. The processor **335** implements the signal transmission and reception method proposed in this specification. The processor **335** determines whether the message ID of an encoded message received from the first controller **310** exists in the blocking table.

Further, the processor **335** updates the blocking table on the basis of a feedback message received from the second controller **350**.

Meanwhile, the processor **335** may include a routing processing unit **336** and a routing precluding unit **337**.

The routing processing unit **336** routes an encoded message received from the first controller **310** on the basis of a routing DB (RDB).

The routing precluding unit **337** blocks routing of an encoded message received from the first controller **310** on the basis of a blocking table.

In this case, the blocking table may have the data format shown in Table 1.

The communication unit **340** is connected with the processor **335** and and/receives transmits all of information for implementing the signal transmission and reception method. For example, the communication unit **340** routes an encoded message routed by the processor or blocks an encoded message precluded from being routed without routing it.

The memory **345** may include a ROM (read-only memory), a RAM (random access memory), a flash memory, a memory card, a storage medium, and/or another storage unit. The memory **345** stores information for implementing the message transmission and reception method. For example, the memory **345** stores at least one or more of an encoded message, a routing DB, a blocking table, or a feedback message, or a combination thereof.

The second controller **350** includes a processor **355**, a communication unit **360**, and a memory **365**.

The processor **355** may include an ASIC (application-specific integrated circuit), another chipset, a logic circuit, and/or a data processing unit. The processor **355** implements the signal transmission and reception method proposed in this specification. The processor **355**, in detail, creates a feedback message that is transmitted to a gateway.

In this case, the feedback message may have a data format shown in Table 2.

The communication unit **360** is connected with the processor **355** and transmits and/receives all of information for implementing the signal transmission and reception method. For example, the communication unit **360** transmits a feedback message created by the processor **355** to the gateway **330**.

The memory **365** may include a ROM (read-only memory), a RAM (random access memory), a flash memory, a memory card, a storage medium, and/or another storage unit. The memory **365** stores information for implementing the message transmission and reception method. For example, the memory **365** stores at least one or more of a VSK, a counter, a MAC value, or an encoded message, or a combination thereof.

According to the implementations of the present disclosure described above, it is possible to quickly filter out forged messages without performing integrity verification at a gateway.

Further, it is possible to quickly filter out forged messages even without performing integrity verification at a gateway.

The invention claimed is:

1. A message transmission and reception method performed at a gateway configured to receive a message from a first controller and transmit the message to a second controller in a vehicle network, the message transmission and reception method comprising:

determining, based on an encoded message being received from the first controller, whether a message identifier (ID) of the encoded message is present within a blocking table; and

transmitting, based on a determination that the message ID of the encoded message being absent in the blocking table, the encoded message to the second controllers,

wherein the blocking table is stored during a current driving cycle of a vehicle and is configured to, based on the current driving cycle being ended or a next driving cycle being started, be reset.

2. The message transmission and reception method of claim 1, further comprising:

receiving a feedback message related to the encoded message from the second controller; and

updating the blocking table based on the feedback message.

3. The message transmission and reception method of claim 2, wherein the feedback message includes at least one of a field indicating that the feedback message is a verification feedback message, a field indicating an ID of the encoded message, a field including a flag for a verification result of the encoded message, or a field including a Message Authentication Code (MAC) value for the feedback message.

4. The message transmission and reception method of claim 3, wherein the feedback message has a size of 12 bytes, the field indicating that the feedback message is a verification feedback message has a size of 1 byte, the field indicating an ID of the encoded message has a size of 2 bytes, the field including a flag for the verification result of the encoded message has a size of 1 byte, and the field including a MAC value for the feedback message has a size of 8 bytes.

5. The message transmission and reception method of claim 3, wherein, based on the field indicating that the feedback message is a verification feedback message having a value of '11', the field indicates that the feedback message is a verification feedback message.

6. The message transmission and reception method of claim 3, wherein the field indicating an ID of the encoded message includes ID information for a message that has failed in verification based on the verification result from the second controller.

7. The message transmission and reception method of claim 3, wherein the field including a flag for the verification result of the encoded message has a value of 'FF' or '00',

wherein the 'FF' value indicates that the encoded message has failed in verification after a verification process of the encoded message, and

wherein the '00' value indicates that an error occurred during the verification process of the encoded message.

8. The message transmission and reception method of claim 1, wherein the blocking table includes a plurality of message ID fields and a plurality of state fields.

9. The message transmission and reception method of claim 8, wherein, based on a state field associated with a message ID field that has an ID identical to the ID of the encoded message having a block value, the encoded message is blocked from being routed to the second controller.

10. A gateway comprising:

a communication unit configured to:

receive an encoded message from a first controller, and

transmit, based on a message identifier (ID) of the encoded message being absent in a blocking table, the encoded message to a second controller; and

a processor configured to determine whether the message ID of the encoded message is present within the blocking table,

wherein the blocking table is stored during a current driving cycle of a vehicle and is configured to, based on the current driving cycle being ended or a next driving cycle being started, be reset.

11. The gateway of claim 10, wherein the communication unit is configured to receive a feedback message related to the encoded message from the second controller, and

wherein the processor is configured to update the blocking table based on the feedback message.

12. The gateway of claim 11, wherein the feedback message includes at least one of a field indicating that the feedback message is a verification feedback message, a field indicating an ID of the encoded message, a field including a flag for a verification result of the encoded message, or a field including a Message Authentication Code (MAC) value for the feedback message.

13. The gateway of claim 12, wherein the feedback message has a size of 12 bytes, the field indicating that the feedback message is a verification feedback message has a size of 1 byte, the field indicating an ID of the encoded message has a size of 2 bytes, the field including a flag for the verification result of the encoded message has a size of 1 byte, and the field including a MAC value for the feedback message has a size of 8 bytes.

14. The gateway of claim 12, wherein, based on the field indicating that the feedback message is a verification feedback message having a value of '11', the field indicates that the feedback message is a verification feedback message.

15. The gateway of claim 12, wherein the field indicating an ID of the encoded message includes ID information for a message that has failed in verification based on the verification result from the second controller.

16. The gateway of claim 12, wherein the field including a flag for the verification result of the encoded message has a value of 'FF' or '00',

wherein the 'FF' value indicates that the encoded message has failed in verification after a verification process of the encoded message, and

wherein the '00' value indicates that an error occurred during the verification process of the encoded message.

17. The gateway of claim 10, wherein the blocking table includes a plurality of message ID fields and a plurality of state fields.

18. The gateway of claim 17, wherein the processor is configured to, based on a state field associated with a message ID field that has an ID identical to the ID of the encoded message having a block value, block the encoded message from being routed to the second controller.

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