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Information processing system, non-transitory storage medium, and information processing method

Abstract

An information processing system includes a first ECU and a second ECU. The first ECU is configured to: communicate with the second ECU; acquire an activation request signal from an external device; determine whether the acquired activation request signal has continued for a prescribed period or more; when the first ECU determines that the activation request signal has continued for the prescribed period or more, identify the external device that has output the activation request signal as an abnormal external device; switch the second ECU to a wake-up mode when the first ECU acquires the activation request signal from the external device that is not the abnormal external device while the second ECU is in a sleep mode; and switch the second ECU to the sleep mode when the first ECU acquires the activation request signal from the abnormal external device.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATION

(1) This application claims priority to Japanese Patent Application No. 2022-209624 filed on Dec. 27, 2022, incorporated herein by reference in its entirety.

BACKGROUND

1. Technical Field

(2) The present disclosure relates to information processing systems, non-transitory storage media, and information processing methods.

2. Description of Related Art

(3) An information processing system disclosed in Japanese Unexamined Patent Application Publication No. 2005-020570 (JP 2005-020570 A) includes a first electronic control unit (ECU), a second ECU, and a door state determination switch. The second ECU switches from a wake-up mode to a sleep mode when a predetermined prescribed condition is satisfied. The first ECU is configured to acquire from the door state determination switch an activation request signal requesting to switch the second ECU to the wake-up mode. The first ECU switches the second ECU from the sleep mode to the wake-up mode when the first ECU acquires the activation request signal while the second ECU is in the sleep mode.

SUMMARY

(4) In such an information processing system as that described in JP 2005-020570 A, the door state determination switch may keep outputting the activation request signal due to some abnormality. In this case, the first ECU may unnecessarily switch the second ECU to the wake-up mode.

(5) An information processing system according to a first aspect of the present disclosure includes a first ECU and a second ECU. The first ECU is configured to communicate with the second ECU, acquire an activation request signal from an external device, and determine whether the acquired activation request signal has continued for a prescribed period or more. The first ECU is configured to, when the first ECU determines that the activation request signal has continued for the prescribed period or more, identify the external device that has output the activation request signal as an abnormal external device. The first ECU is configured to switch the second ECU to a wake-up mode when the first ECU acquires the activation request signal from the external device that is not the abnormal external device while the second ECU is in a sleep mode. The first ECU is configured to switch the second ECU to the sleep mode when the first ECU acquires the activation request signal from the abnormal external device.

(6) In the information processing system according to the first aspect of the present disclosure, the first ECU may be configured to switch the second ECU to the sleep mode, when the first ECU acquires the activation request signal from the abnormal external device and does not acquire the activation request signal from the external device that is not the abnormal external device.

(7) In the information processing system according to the first aspect of the present disclosure, the first ECU may be configured to acquire the activation request signal from a plurality of the external devices, and the first ECU may be configured not to identify a predetermined specific external device out of the external devices as the abnormal external device even when the activation request signal from the specific external device has continued for the prescribed period or more.

(8) In the information processing system according to the first aspect of the present disclosure, the first ECU may be configured to reset data regarding whether the external device is the abnormal external device every time a prescribed timing comes.

(9) In the information processing system according to the first aspect of the present disclosure, the prescribed timing may be a timing when a main switch configured to operate a system of a vehicle is turned on or off.

(10) In the information processing system according to the first aspect of the present disclosure, the first ECU may be configured to acquire the activation request signal from a plurality of the external devices. The first ECU may be configured to, even when the first ECU acquires the activation request signal from the abnormal external device, switch the second ECU to the wake-up mode when the first ECU acquires the activation request signal from the external device that is not the abnormal external device while the second ECU is in the sleep mode.

(11) A non-transitory storage medium according to a second aspect of the present disclosure stores instructions that are executable by one or more processors of a first ECU and that cause the one or more processors to perform functions. The functions include: communicating with a second ECU; acquiring an activation request signal from an external device; determining whether the acquired activation request signal has continued for a prescribed period or more; when determination is made that the activation request signal has continued for the prescribed period or more, identifying the external device that has output the activation request signal as an abnormal external device; switching the second ECU to a wake-up mode when the activation request signal is acquired from the external device that is not the abnormal external device while the second ECU is in a sleep mode; and switching the second ECU to the sleep mode when the activation request signal is acquired from the abnormal external device.

(12) An information processing method that is performed by a first ECU according to a third aspect of the present disclosure includes: communicating with a second ECU; acquiring an activation request signal from an external device; determining whether the acquired activation request signal

has continued for a prescribed period or more; when determination is made that the activation request signal has continued for the prescribed period or more, identifying the external device that has output the activation request signal as an abnormal external device; switching the second ECU to a wake-up mode when the activation request signal is acquired from the external device that is not the abnormal external device while the second ECU is in a sleep mode; and switching the second ECU to the sleep mode when the activation request signal is acquired from the abnormal external device.

(13) With each of the above configurations, even if a certain external device keeps outputting an activation request signal due to some abnormality, the second ECU will not be switched to the wake-up mode in response to the activation request signal from the external device in a situation where the activation request signal from the external device has continued for the prescribed period or more. That is, the second ECU is less likely to be unnecessarily switched to the wake-up mode even if some abnormality occurs in the external device.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) Features, advantages, and technical and industrial significance of exemplary embodiments of the present disclosure will be described below with reference to the accompanying drawings, in which like signs denote like elements, and wherein:

(2) FIG. **1** is a schematic configuration diagram of a vehicle;

(3) FIG. **2** is a flowchart of flag setting control; and

(4) FIG. **3** is a flowchart of activation control.

DETAILED DESCRIPTION OF EMBODIMENTS

(5) Schematic Configuration of Vehicle

(6) An embodiment of the present disclosure will be described below with reference to FIGS. **1** to **3**. First, a schematic configuration of a vehicle **100** will be described.

(7) FIG. **1** is a schematic configuration diagram of the vehicle **100**. As shown in FIG. **1**, the vehicle **100** includes an engine ECU **10**, a multimedia ECU **20**, an advanced driver assistance ECU **30**, and a body ECU **40**. The term “ECU” is an abbreviation for “electronic control unit.” The vehicle **100** further includes a bus **60** and a battery **65**. The bus **60** connects the engine ECU **10**, the multimedia ECU **20**, the advanced driver assistance ECU **30**, and the body ECU **40** to each other so that the engine ECU **10**, the multimedia ECU **20**, the advanced driver assistance ECU **30**, and the body ECU **40** can communicate with each other. The battery **65** supplies power to the engine ECU **10**, the multimedia ECU **20**, the advanced driver assistance ECU **30**, and the body ECU **40**.

(8) The engine ECU **10** controls an engine, not shown. In the present embodiment, the engine is a driving source for the vehicle **100**. The multimedia ECU **20** controls a navigation device, an audio device, etc., not shown. The advanced driver assistance ECU **30** implements various kinds of driver assistance by executing various kinds of application software. The various kinds of application software include application software for the vehicle **100** to follow a preceding vehicle traveling ahead of the vehicle **100** while a constant following distance is maintained.

(9) Each of the engine ECU **10**, the multimedia ECU **20**, and the advanced driver assistance ECU **30** receives an activation signal SZ from the body ECU **40** in a sleep mode. Each of the engine ECU **10**, the multimedia ECU **20**, and the advanced driver assistance ECU **30** switches from the sleep mode to a wake-up mode in response to reception of the activation signal SZ. The sleep mode is a mode in which only predetermined minimum functions are enabled out of functions that can be implemented by each ECU. Examples of the minimum functions are functions related to reception of the activation signal SZ and to a process associated with reception of the activation signal SZ. The wake-up mode is a mode in which each ECU can perform its main functions. That is, the

engine ECU **10** can control the engine in the wake-up mode. The multimedia ECU **20** can control the navigation device, the audio device, etc. in the wake-up mode. The advanced driver assistance ECU **30** can execute each piece of application software related to driver assistance in the wake-up mode. Therefore, when the engine ECU **10**, the multimedia ECU **20**, and the advanced driver assistance ECU **30** are in the sleep mode, power consumption of the battery **65** is reduced compared to when they are in the wake-up mode. Each of the engine ECU **10**, the multimedia ECU **20**, and the advanced driver assistance ECU **30** switches from the wake-up mode to the sleep mode when a predetermined sleep transition condition is satisfied. An example of the sleep transition condition is that the vehicle **100** is in a system OFF mode and a predetermined period or more has elapsed since the most recent activation signal SZ was received. In the present embodiment, each of the engine ECU **10**, the multimedia ECU **20**, and the advanced driver assistance ECU **30** is an example of the second ECU.

(10) The body ECU **40** controls opening and closing of doors of the vehicle **100** etc. The body ECU **40** includes a central processing unit (CPU) **41** and a storage device **42**. The storage device **42** includes a read-only memory (ROM), a random access memory (RAM), and a storage. The storage device **42** stores various programs and various kinds of data in advance. The storage device **42** stores a mode control application **42**A as one of the various programs. The mode control application **42**A is application software for implementing flag setting control and activation control that will be described later. The CPU **41** implements various processes (functions) by executing the various programs stored in the storage device **42**. In the present embodiment, the body ECU **40** is an example of the first ECU. Therefore, the engine ECU **10**, the multimedia ECU **20**, the advanced driver assistance ECU **30**, and the body ECU **40** form an information processing system. The mode control application **42**A is an example of an information processing program. A series of methods that is implemented by the body ECU **40** executing the mode control application **42**A is an example of the information processing method. The CPU **41** may be a processor. The storage device **42** may be a non-transitory storage medium.

(11) As shown in FIG. **1**, the vehicle **100** includes a door sensor **71**, a kick sensor **72**, and a main switch **73**. The door sensor **71** is located near a door handle of the door of the vehicle **100**. For example, when a user of the vehicle **100** is touching the door handle, the door sensor **71** outputs an ON signal. For example, when the user of the vehicle **100** is not touching the door handle, the door sensor **71** outputs an OFF signal.

(12) The kick sensor **72** is mounted at a position near an under panel of the vehicle **100** and below the door of the vehicle **100**. For example, when a foot of the user of the vehicle **100** is located near the kick sensor **72**, the kick sensor **72** outputs an ON signal. For example, when a foot of the user of the vehicle **100** is not located near the kick sensor **72**, the kick sensor **72** outputs an OFF signal.

(13) The main switch **73** is located near a driver's seat of the vehicle **100**. The main switch **73** is a switch for operating a system of the vehicle **100**. The main switch **73** is also called a start switch, an ignition switch, etc. The main switch **73** outputs a switching signal every time the user of the vehicle **100** presses the main switch **73**. When the main switch **73** is pressed while the vehicle **100** is in a system ON mode, the vehicle **100** is switched to the system OFF mode. Therefore, the operation of pressing the main switch **73** while the vehicle **100** is in the system ON mode is an operation of turning off the main switch **73**. When the main switch **73** is pressed while the vehicle **100** is in the system OFF mode, the vehicle **100** is switched to the system ON mode. Therefore, the operation of pressing the main switch **73** while the vehicle **100** is in the system OFF mode is an operation of turning on the main switch **73**.

(14) The door sensor **71**, the kick sensor **72**, and the main switch **73** can communicate with the body ECU **40** via a wired communication path different from the bus **60**. The body ECU **40** can acquire signals from each of the door sensor **71**, the kick sensor **72**, and the main switch **73**. In the present embodiment, each of the ON signal from the door sensor **71** and the ON signal from the kick sensor **72** is an example of the activation request signal SA. The switching signal from the

main switch **73** when the vehicle **100** is in the system OFF mode is an example of the activation request signal SA. Therefore, the door sensor **71**, the kick sensor **72**, and the main switch **73** are an example of the plurality of external devices.

(15) Flag Setting Control

(16) Next, the flag setting control that is performed by the body ECU **40** will be described with reference to FIG. **2**. FIG. **2** is a flowchart of the flag setting control. The body ECU **40** performs the flag setting control for the door sensor **71** and the kick sensor **72** out of the door sensor **71**, the kick sensor **72**, and the main switch **73**. That is, in the present embodiment, the main switch **73** is a specific external device determined in advance to be excluded from the flag setting control. The body ECU **40** repeatedly performs the flag setting control at every predetermined control cycle. The body ECU **40** separately performs the flag setting control for the door sensor **71** and the flag setting control for the kick sensor **72** in parallel with each other. In the following description, the door sensor **71** and the kick sensor **72** may be referred to as "external devices" when it is not necessary to distinguish between them.

(17) As shown in FIG. **2**, after the body ECU **40** starts the flag setting control, it first performs step S**11**. In step S**11**, the body ECU **40** determines whether there is an activation request signal SA from any external device for which the flag setting control is to be performed (whether the body ECU **40** has received an activation request signal SA from any external device). When the body ECU **40** determines in step S**11** that there is no activation request signal SA from any external device (the body ECU **40** has not received an activation request signal SA from any external device) (S**11**: NO), the body ECU **40** ends the current flag setting control. The body ECU **40** starts the flag setting control at every control cycle, and the body ECU **40** proceeds the process to step S**11** again. On the other hand, when the body ECU **40** determines in step S**11** that there is an activation request signal SA from any external device (S**11**: YES), the body ECU **40** proceeds the process to step S**12**.

(18) In step S**12**, the body ECU **40** determines whether the activation request signal SA has continued for a predetermined prescribed period A or more (the body ECU **40** has been continuously receiving the activation request signal SA for the predetermined prescribed period A or more). Specifically, the body ECU **40** determines that the activation request signal SA has continued for the prescribed period A or more when either or both of the following conditions (1) and (2) are satisfied.

(19) Condition (1): The body ECU **40** has been continuously acquiring the activation request signal SA for the period from the prescribed period A before the time when step S**12** is performed to the time when step S**12** is performed.

(20) Condition (2): The body ECU **40** has acquired the activation request signal SA a predetermined prescribed number of times B or more during the period from the prescribed period A before the time when step S**12** is performed to the time when step S**12** is performed.

(21) Regarding Condition (2), when a signal from the door sensor **71** sequentially changes in order of an ON signal, an OFF signal, and an ON signal, it means that the activation request signal SA is acquired twice. An example of the prescribed period A is several minutes to several tens of minutes. An example of the prescribed number of times B is several tens of times to several hundreds of times.

(22) When the body ECU **40** determines in step S**12** that the activation request signal SA has not continued for the prescribed period A or more (S**12**: NO), the body ECU **40** ends the current flag setting control. The body ECU **40** then starts the flag setting control again, and the process proceeds to step S**11**.

(23) On the other hand, when the body ECU **40** determines in step S**12** that the activation request signal SA has continued for the prescribed period A or more (S**12**: YES), the body ECU **40** proceeds the process to step S**13**.

(24) In step S**13**, the body ECU **40** sets an abnormality flag F corresponding to the external device

for which the flag setting control is to be performed to ON. In the present embodiment, setting the abnormality flag F to ON indicates identifying an external device that has output an activation request signal SA as an abnormal external device when this activation request signal SA has continued for the prescribed period A or more. The abnormality flag F was OFF at the time the vehicle **100** was manufactured. After step S**13**, the process proceeds to step S**14**.

(25) In step S**14**, the body ECU **40** determines whether a predetermined forced sleep condition is satisfied. An example of the forced sleep condition is that the body ECU **40** has acquired an activation request signal SA only from the external device whose abnormality flag F is ON. When the body ECU **40** determines in step S**14** that the forced sleep condition is not satisfied (S**14**: NO), the body ECU **40** ends the current flag setting control. The body ECU **40** then starts the flag setting control again, and the process proceeds to step S**11**. On the other hand, when the body ECU **40** determines in step S**14** that the forced sleep condition is satisfied (S**14**: YES), the body ECU **40** proceeds the process to step S**15**.

(26) In step S**15**, the body ECU **40** outputs a forced sleep signal SX to the engine ECU **10**, the multimedia ECU **20**, and the advanced driver assistance ECU **30**. Each of the engine ECU **10**, the multimedia ECU **20**, and the advanced driver assistance ECU **30** switches from the wake-up mode to the sleep mode in response to the forced sleep signal SX received from the body ECU **40** while in the wake-up mode. Therefore, in step S**15**, the body ECU **40** switches the engine ECU **10** etc. from the wake-up mode to the sleep mode when the body ECU **40** acquires the activation request signal SA from the abnormal external device. After step S**15**, the body ECU **40** ends the current flag setting control. The body ECU **40** then starts the flag setting control again, and the process proceeds to step S**11**.

(27) As described above, in the present embodiment, the main switch **73** is a specific external device excluded from the flag setting control. Since the main switch **73** is a specific external device, the body ECU **40** will not identify the main switch **73** that is the specific external device as an abnormal external device even when an activation request signal SA from the main switch **73** has continued for the prescribed period A or more.

(28) The body ECU **40** sets all the abnormality flags F to OFF, every time the main switch **73** is turned on. In the present embodiment, the timing the main switch **73** is turned on is an example of the predetermined prescribed timing. Setting all the abnormality flags F to OFF is an example of resetting data regarding whether the external devices are abnormal external devices.

(29) Activation Control

(30) Next, the activation control that is performed by the body ECU **40** will be described with reference to FIG. **3**. The body ECU **40** repeatedly performs the activation control at every predetermined control cycle.

(31) As shown in FIG. **3**, after the body ECU **40** starts the activation control, it first performs step S**31**. In step S**31**, the body ECU **40** determines whether there is an activation request signal SA from any external device (whether the body ECU **40** has received an activation request signal SA from any external device). When the body ECU **40** determines in step S**31** that there is no activation request signal SA from any external device (S**31**: NO), the body ECU **40** ends the current activation control. The body ECU **40** then starts the activation control again, and the process proceeds to step S**31**. On the other hand, when the body ECU **40** determines in step S**31** that there is an activation request signal SA from any external device (S**31**: YES), the process proceeds to step S**32**.

(32) In step S**32**, the body ECU **40** determines whether the abnormality flag F corresponding to every external device that has output the activation request signal SA is ON. When the body ECU **40** determines in step S**32** that all the abnormality flags F corresponding to the external devices outputting the activation request signal SA are ON (S**32**: YES), the body ECU **40** ends the current activation control. The process then returns to step S**31**. In other words, when the body ECU **40** acquires the activation request signal SA only from the abnormal external device(s), the body ECU

40 does not perform step S**41** that will be described later. That is, the body ECU **40** does not output an activation signal SZ.
(33) On the other hand, when the body ECU **40** determines in step S**32** that at least one of the abnormality flags F corresponding to the external devices outputting the activation request signal SA is OFF (S**32**: NO), the process proceeds to step S**41**. In other words, when the body ECU **40** acquires an activation request signal SA from any external device that is not an abnormal external device, the body ECU **40** proceeds the process to step S**41**.
(34) In step S**41**, the body ECU **40** outputs an activation signal SZ to the engine ECU **10**, the multimedia ECU **20**, and the advanced driver assistance ECU **30**. After step S**41**, the body ECU **40** ends the current activation control. The body ECU **40** then starts the activation control again, and the process proceeds to step S**31**.
Functions of Embodiment
(35) For example, it is herein assumed that the kick sensor **72** keeps outputting an activation request signal SA due to some abnormality or the surrounding environment. In this case, the body ECU **40** outputs an activation signal SZ to the engine ECU **10**, the multimedia ECU **20**, and the advanced driver assistance ECU **30** by step S**41** of the activation control. The engine ECU **10**, the multimedia ECU **20**, and the advanced driver assistance ECU **30** therefore switch to the wake-up mode. However, when the prescribed period A has elapsed after the kick sensor **72** started outputting the activation request signal SA, the abnormality flag F corresponding to the kick sensor **72** is set to ON by the flag setting control. Moreover, the body ECU **40** outputs a forced sleep signal SX. As a result, the engine ECU **10**, the multimedia ECU **20**, and the advanced driver assistance ECU **30** are forced into the sleep mode. In the subsequent activation controls, even when it is determined in step S**31** that there is an activation request signal SA from the kick sensor **72**, it is determined in step S**32** that the abnormality flag F corresponding to the kick sensor **72** is ON. That is, step S**41** will not be performed unless there is an activation request signal SA from any other external device. Therefore, the body ECU **40** does not output an activation signal SZ. As a result, the engine ECU **10**, the multimedia ECU **20**, and the advanced driver assistance ECU **30** do not receive an activation signal SZ. Therefore, each of these ECUs does not switch the wake-up mode.
(36) It is assumed that the door sensor **71** also outputs an activation request signal SA after the prescribed period A has elapsed since the kick sensor **72** started outputting an activation request signal SA. In this case, it is determined in step S**32** of the activation control that the abnormality flag F of one of the external devices outputting the activation request signal SA is OFF, and the process proceeds to step S**41**. In step S**41**, the body ECU **40** outputs an activation signal SZ to the engine ECU **10**, the multimedia ECU **20**, and the advanced driver assistance ECU **30**. The engine ECU **10**, the multimedia ECU **20**, and the advanced driver assistance ECU **30** therefore switch from the sleep mode to the wake-up mode in response to the activation signal SZ from the body ECU **40**. In other words, even when the body ECU **40** acquires an activation request signal SA from an abnormal external device, the engine ECU **10** etc. are switched to the wake-up mode when the body ECU **40** also acquires an activation request signal SA from an external device that is not an abnormal external device while the engine ECU **10** etc. are in the sleep mode.
Effects of Embodiment
(37) (1) In the present embodiment, for example, even when the kick sensor **72** keeps outputting an activation request signal SA, the abnormality flag F corresponding to the kick sensor **72** is set to ON in a situation where the activation request signal SA from the kick sensor **72** has continued for the prescribed period A or more. In this case, even when the kick sensor **72** keeps outputting the activation request signal SA, the body ECU **40** will not output an activation signal SZ unless the body ECU **40** receives an activation request signal SA from any other external device. Therefore, the engine ECU **10**, the multimedia ECU **20**, and the advanced driver assistance ECU **30** will not be unnecessarily switched from the sleep mode to the wake-up mode in response to the activation

request signal SA from the abnormal kick sensor **72**. As described above, even if some abnormality occurs in an external device, the engine ECU **10**, the multimedia ECU **20**, and the advanced driver assistance ECU **30** are less likely to be unnecessarily switched to the wake-up mode due to an activation request signal SA from the abnormal external device. For example, this reduces power consumption of the battery **65** due to the engine ECU **10**, the multimedia ECU **20**, and the advanced driver assistance ECU **30** being switched to the wake-up mode.

(38) (2) For example, even when the abnormality flag F corresponding to the kick sensor **72** is ON, there is a high necessity to switch the engine ECU **10** etc. to the wake-up mode when an activation request signal SA is output from the normal door sensor **71** that is not an abnormal external device. In the present embodiment, when an activation request signal SA is output from the normal door sensor **71** in addition to an activation request signal SA from the abnormal kick sensor **72**, the body ECU **40** outputs an activation signal SZ to the engine ECU **10** etc. Accordingly, even in a situation where the abnormality flag F is ON, that is, even in a situation where an activation request signal SA is output from an abnormal external device, the engine ECU **10** etc. can be switched to the wake-up mode in response to an activation request signal SA from a normal external device.

(39) (3) For example, an external device may keep outputting an activation request signal SA due to the surrounding environment of the external device rather than abnormality of the external device itself. In this case, the external device may be able to output a normal activation request signal SA as time elapses etc.

(40) In this regard, in the present embodiment, the body ECU **40** sets all the abnormality flags F to OFF, that is, resets the data regarding whether the external devices are abnormal external devices, every time the predetermined prescribed timing comes. This reduces the possibility of an external device continuing to be identified as an abnormal external device.

(41) (4) In the present embodiment, the predetermined prescribed timing is the timing when the main switch **73** is turned on. The timing when the main switch **73** is turned on is very likely to be when a trip of the vehicle **100** starts. In the vehicle **100**, the environment around the vehicle **100** changes for each trip, for example, with a change in parking location. Accordingly, there is a possibility that an external device identified as an abnormal external device may function properly. That is, the timing when the main switch **73** is turned on is suitable as the timing to reset the data regarding whether the external devices are abnormal external devices.

(42) (5) If the abnormality flag F corresponding to the main switch **73** is set to ON, the engine ECU **10** etc. may not be switched from the sleep mode to the wake-up mode in response to an activation request signal SA from the main switch **73**. In this case, for example, even when the user of vehicle **100** operates the main switch **73**, the system of the vehicle **100** may not be activated appropriately.

(43) In this regard, in the present embodiment, the main switch **73** is a predetermined specific external device. Since the main switch **73** is a specific external device, the body ECU **40** will not identify the main switch **73** that is the specific external device as an abnormal external device even when an activation request signal SA from the main switch **73** has continued for the prescribed period A or more. That is, for example, even when the main switch **73** keeps outputting an activation request signal SA, the abnormality flag F corresponding to the main switch **73** will not be set to ON. Each of the engine ECU **10**, the multimedia ECU **20**, and the advanced driver assistance ECU **30** can thus be switched from the sleep mode to the wake-up mode in response to the activation request signal SA from the main switch **73**.

Modifications

(44) The above embodiment can be modified as follows. The above embodiment and the following modifications may be combined as long as no technical contradiction arises.

(45) In the above embodiment, the flag setting control may be changed. For example, in step S**12**, only Condition (1) may be used as a condition to determine that an activation request signal SA has continued for the prescribed period A or more. Alternatively, for example, in step S**12**, only Condition (2) may be used as the condition to determine that an activation request signal SA has

continued for the prescribed period A or more.
(46) For example, steps S**14** and S**15** may be omitted. Specifically, even when a forced sleep signal SX is not output in step S**15**, the sleep transition condition may be satisfied when an activation signal SZ is no longer output due to the abnormality flag F being set to ON in step S**13**. As a result, the engine ECU **10** etc. can be switched from the wake-up mode to the sleep mode even when steps S**14** and S**15** are omitted.
(47) In the above embodiment, the configuration for resetting the data regarding whether the external devices are abnormal external devices may be changed. For example, the body ECU **40** may set all the abnormality flags F to OFF every time the main switch **73** is turned off instead of every time the main switch **73** is turned on.
(48) Alternatively, for example, the body ECU **40** may set all the abnormality flags F to OFF in every time of at least one of the following cases: (i) the main switch **73** is turned on, and (ii) the main switch **73** is turned off.
(49) For example, the body ECU **40** may set the abnormality flag F to OFF every time a predetermined period has elapsed since the abnormality flag F was set. That is, as described above, the prescribed timing to reset the data regarding whether the external devices are abnormal external devices can be changed.
(50) For example, the body ECU **40** may not set the abnormality flag F to OFF. As a specific example, the abnormality flag F corresponding to an external device may be set to ON due to a failure of the external device. In this case, instead of the body ECU **40** setting the abnormality flag F to OFF, an operator who performs maintenance of the vehicle **100**, for example, preferably sets the abnormality flag F to OFF after replacing the broken external device with a new external device during the maintenance.
(51) In the above embodiment, the activation control may be changed. For example, in the activation control, the body ECU **40** may switch the engine ECU **10** etc. from the wake-up mode to the sleep mode when the body ECU **40** acquires an activation request signal SA from any abnormal external device. As a specific example, when the body ECU **40** determined YES in step S**32**, the body ECU **40** may then perform the process of outputting a forced sleep signal SX to the engine ECU **10**, the multimedia ECU **20**, and the advanced driver assistance ECU **30**. In this case, steps S**14** and S**15** can be omitted from the flag setting control.
(52) In the above embodiment, the configuration related to the external devices may be changed. For example, the external devices are not limited to the door sensor **71**, the kick sensor **72**, and the main switch **73**. As a specific example, sensors such as a proximity sensor configured to detect an object etc. outside the vehicle **100** may be used as the external devices. Alternatively, as a specific example, the external devices may be ECUs. That is, any devices, such as sensors, switches, and ECUs, that can output an activation request signal SA to the first ECU may be used as the external devices.
(53) For example, the number of external devices may be changed. As a specific example, the number of external devices may be two or less, or may be four or more. That is, the number of external devices may be changed as long as it is one or more.
(54) For example, the activation request signal SA from the external device may be changed. As a specific example, depending on the configuration of the door sensor **71**, the door sensor **71** outputs an OFF signal when, for example, the user of the vehicle **100** is touching a door knob. In this case, the activation request signal SA may be the OFF signal from the door sensor **71** etc. Similarly, the activation request signal SA from the kick sensor **72** etc. may be changed. In the above specific example, for example, the OFF signal from the door sensor **71** may be used as an activation request signal SA, whereas the ON signal from the kick sensor **72** may be used as an activation request signal SA.
(55) For example, the specific external device may be changed. As a specific example, instead of or in addition to the main switch **73**, the door sensor **71** may be a specific external device. That is, any

external device can be a specific external device.
(56) For example, the number of specific external devices may be changed. As a specific example, the number of specific external devices may be two or more. As another specific example, the number of specific external devices may be zero. That is, a specific external device need not necessarily be set.
(57) In the above embodiment, the configuration related to the first ECU may be changed. For example, the first ECU is not limited to the body ECU **40**. As a specific example, one of the engine ECU **10**, the multimedia ECU **20**, and the advanced driver assistance ECU **30** may be used as the first ECU instead of the body ECU **40** as long as that ECU can acquire an activation request signal SA from an external device.
(58) In the above embodiment, the configuration related to the second ECUs may be changed. For example, the second ECUs are not limited to the engine ECU **10**, the multimedia ECU **20**, and the advanced driver assistance ECU **30**. As a specific example, a transmission ECU, a brake ECU, etc. in the vehicle **100** may be used as the second ECUs as long as they can communicate with the first ECU via the bus **60**.
(59) For example, the number of second ECUs may be changed. As a specific example, the number of second ECUs may be two or less, or may be four or more. That is, the number of second ECUs may be changed as long as it is one or more.
(60) In the above embodiment, the connection configuration between the first ECU and the second ECUs may be changed. For example, the first ECU may be connected to the second ECUs via connection lines that directly connect devices one-to-one, namely so-called direct lines, instead of via the bus **60**. That is, the connection configuration between the first ECU and the second ECUs may be changed as long as the first ECU can communicate with the second ECUs.
(61) Other Technical Ideas
(62) Technical ideas that can be grasped from the above embodiment and modifications will be described.
(63) Note 1
(64) An information processing system includes a first ECU and a second ECU. The first ECU is configured to communicate with a second ECU, acquire an activation request signal from an external device, determine whether the acquired activation request signal has continued for a predetermined prescribed period or more, when the first ECU determines that the activation request signal has continued for the prescribed period or more, identify the external device that has output the activation request signal as an abnormal external device, switch the second ECU to a wake-up mode when the first ECU acquires the activation request signal from the external device that is not the abnormal external device while the second ECU is in a sleep mode, and switch the second ECU to the sleep mode when the first ECU acquires the activation request signal from the abnormal external device.
(65) Note 2
(66) In the information processing system according to note 1, the first ECU is configured to switch the second ECU to the sleep mode when the first ECU acquires the activation request signal from the abnormal external device and does not acquire the activation request signal from the external device that is not the abnormal external device.
(67) Note 3
(68) In the information processing system according to note 1, the first ECU is configured to acquire the activation request signal from a plurality of the external devices, and for a predetermined specific external device out of the external devices, not identify the specific external device as the abnormal external device even when the activation request signal from the specific external device has continued for the prescribed period or more.
(69) Note 4
(70) In the information processing system according to note 1, the first ECU is configured to reset

data regarding whether the external device is the abnormal external device every time a predetermined prescribed timing comes.
(71) Note 5
(72) In the information processing system according to note 4, the prescribed timing is a timing when a main switch configured to operate a system of a vehicle is turned on or off.
(73) Note 6
(74) In the information processing system according to note 1, the first ECU is configured to acquire the activation request signal from a plurality of the external devices, and even when the first ECU acquires the activation request signal from the abnormal external device, switch the second ECU to the wake-up mode when the first ECU acquires the activation request signal from the external device that is not the abnormal external device while the second ECU is in the sleep mode.
(75) Note 7
(76) A non-transitory storage medium stores instructions that are executable by one or more processors of a first ECU and that cause the one or more processors to perform functions including: communicating with a second ECU; acquiring an activation request signal from an external device; determining whether the acquired activation request signal has continued for a predetermined prescribed period or more; when determination is made that the activation request signal has continued for the prescribed period or more, identifying the external device that has output the activation request signal as an abnormal external device; switching the second ECU to a wake-up mode when the activation request signal is acquired from the external device that is not the abnormal external device while the second ECU is in a sleep mode; and switching the second ECU to the sleep mode when the activation request signal is acquired from the abnormal external device.
(77) Note 8
(78) An information processing method that is performed by a first ECU includes: communicating with a second ECU; acquiring an activation request signal from an external device; determining whether the acquired activation request signal has continued for a predetermined prescribed period or more; when determination is made that the activation request signal has continued for the prescribed period or more, identifying the external device that has output the activation request signal as an abnormal external device; switching the second ECU to a wake-up mode when the activation request signal is acquired from the external device that is not the abnormal external device while the second ECU is in a sleep mode; and switching the second ECU to the sleep mode when the activation request signal is acquired from the abnormal external device.

Claims

1. An information communication system comprising: a first electronic control unit configured to communicate with a second electronic control unit, acquire an activation request signal from an external device, determine whether the acquired activation request signal has continued for a prescribed period or more, when the first electronic control unit determines that the activation request signal has continued for the prescribed period or more, identify the external device that has output the activation request signal as an abnormal external device, switch the second electronic control unit to a wake-up mode when the first electronic control unit acquires the activation request signal from the external device that is not the abnormal external device while the second electronic control unit is in a sleep mode, and switch the second electronic control unit to the sleep mode when the first electronic control unit acquires the activation request signal from the abnormal external device; and the second electronic control unit.
2. The information processing system according to claim 1, wherein the first electronic control unit is configured to switch the second electronic control unit to the sleep mode, when the first electronic control unit acquires the activation request signal from the abnormal external device and

does not acquire the activation request signal from the external device that is not the abnormal external device.

3. The information processing system according to claim 1, wherein the first electronic control unit is configured to acquire the activation request signal from a plurality of the external devices, and the first electronic control unit is configured not to identify a predetermined specific external device out of the external devices as the abnormal external device even when the activation request signal from the specific external device has continued for the prescribed period or more.

4. The information processing system according to claim 1, wherein the first electronic control unit is configured to reset data regarding whether the external device is the abnormal external device every time a prescribed timing comes.

5. The information processing system according to claim 4, wherein the prescribed timing is a timing when a main switch configured to operate a system of a vehicle is turned on or off.

6. The information processing system according to claim 1, wherein the first electronic control unit is configured to acquire the activation request signal from a plurality of the external devices, and even when the first electronic control unit acquires the activation request signal from the abnormal external device, switch the second electronic control unit to the wake-up mode when the first electronic control unit acquires the activation request signal from the external device that is not the abnormal external device while the second electronic control unit is in the sleep mode.

7. A non-transitory storage medium storing instructions that are executable by one or more processors of a first electronic control unit and that cause the one or more processors to perform functions comprising: communicating with a second electronic control unit; acquiring an activation request signal from an external device; determining whether the acquired activation request signal has continued for a prescribed period or more; when determination is made that the activation request signal has continued for the prescribed period or more, identifying the external device that has output the activation request signal as an abnormal external device; switching the second electronic control unit to a wake-up mode when the activation request signal is acquired from the external device that is not the abnormal external device while the second electronic control unit is in a sleep mode; and switching the second electronic control unit to the sleep mode when the activation request signal is acquired from the abnormal external device.

8. An information processing method that is performed by a first electronic control unit, the information processing method comprising: communicating with a second electronic control unit; acquiring an activation request signal from an external device; determining whether the acquired activation request signal has continued for a prescribed period or more; when determination is made that the activation request signal has continued for the prescribed period or more, identifying the external device that has output the activation request signal as an abnormal external device; switching the second electronic control unit to a wake-up mode when the activation request signal is acquired from the external device that is not the abnormal external device while the second electronic control unit is in a sleep mode; and switching the second electronic control unit to the sleep mode when the activation request signal is acquired from the abnormal external device.