

Suppose the self terminal exits in an environment that disables reception of GNSS waves. In such a case, the nearby in-vehicle unit 1B is also highly likely to exist in an environment that disables reception of GNSS waves. Like the self terminal, the nearby in-vehicle unit 1B also records the diagnostic information indicating unsuccessful reception of GNSS waves. Thus, an influence from the outside environment reflects on the normal range configured based on the diagnostic history information acquired from the nearby in-vehicle unit 1B.

[0115]

The mode of the embodiment can therefore reduce a possibility of determining the operation not to be normal though the operation is normal.

[0116]

The determination at S12 may result in that the anomaly determination condition is satisfied. In this case, S12 goes to YES and the process proceeds to S13. The determination at S12 may result in that the anomaly determination condition is not satisfied. In this case, S12 goes to NO and the process flow terminates.

[0117]

At S13, the self-terminal anomaly notification section F10 requests the wide area communication control section F9 to transmit a self-terminal anomaly notification to the center 3. The wide area communication control section F9 transmits the self-terminal anomaly notification to the center 3 based on the request from the self-terminal anomaly notification section F10. The process flow then terminates.

[0118]

(Different-terminal diagnosis process)

With reference to a flowchart in FIG. 7, the description below explains a process (referred to as a different-terminal diagnosis process) performed by the controller 11 to diagnose any nearby in-vehicle unit 1B. This flowchart may start at the moment the index data-item is acquired from any nearby in-vehicle unit 1B. Obviously, it may be favorable to appropriately design a condition to start the different-terminal diagnosis process, which may start when the index data generation section F3 generates an index data-item, for example.

[0119]

CLAIMS

1. An in-vehicle unit that is mounted on each of a plurality of host vehicles including a subject vehicle and at least one nearby vehicle near the subject vehicle, the in-vehicle unit being used in a system to perform inter-vehicle communication, the in-vehicle unit in each host vehicle, comprising:
 - a wireless communicator that transmits and receives information using inter-vehicle communication;
 - a system information acquisition section that acquires information indicating a state of a control system to control operation of the in-vehicle unit in each host vehicle; and
 - an index data generation section that generates an index data-item including an index value indicating a state of the control system based on the information acquired by the system information acquisition section, the generated index data-item being transmitted via the wireless communicator,wherein a subject in-vehicle unit being the in-vehicle unit used in the subject vehicle further includes:
 - a communication processing section that acquires, via the wireless communicator, an index data-item transmitted from at least one nearby in-vehicle unit being the in-vehicle unit used in the at least one nearby vehicle;
 - a determination criterion specification section that successively specifies a self-unit determination criterion being a determination criterion to determine whether the control system in the subject in-vehicle unit operates normally, based on the index data-item acquired by the communication processing section from the at least one nearby in-vehicle unit; and
 - a self-unit diagnosis test section that determines whether the control system in the subject in-vehicle unit operates normally by comparing the self-unit determination criterion specified by the determination criterion specification section with the index data-item in the subject in-vehicle unit.

2. The in-vehicle unit according to claim 1,

wherein

in the subject in-vehicle unit:

the determination criterion specification section successively specifies a different-unit determination criterion being a determination criterion to determine whether the control system in a target nearby in-vehicle unit as a predetermined diagnosis target among the at least one nearby in-vehicle operates normally, based on an index data-item acquired by the communication processing section from the at least one nearby in-vehicle unit; and

a different-unit diagnosis test section is provided to determine whether the control system in the target nearby in-vehicle unit operates normally, by comparing the different-unit determination criterion specified by the determination criterion specification section with the index data-item acquired by the communication processing section from the target nearby in-vehicle unit.

3. The in-vehicle unit according to claim 2,

wherein the index data-item includes a plurality of types of the index value;

wherein in the subject in-vehicle unit:

the determination criterion specification section specifies a normal range, as the self-unit determination criterion and the different-unit determination criterion, based on the index data-item acquired by the communication processing section from the at least one nearby in-vehicle unit,

the normal range being specified as assuming the index value to be normal, with respect to each of the types of the index value in the index data-item;

the self-unit diagnosis test section determines whether the control system in the subject in-vehicle unit operates normally by determining whether the index value in the index data-item in the subject in-vehicle unit falls within the normal range corresponding to the index value with respect to each of the types of the index value; and

the different-unit diagnosis test section determines whether the control system in the target nearby in-vehicle unit operates normally by determining whether

the index value in the index data-item acquired from the target nearby in-vehicle unit falls within the normal range corresponding to the index value with respect to each of the types of the index value.

4. The in-vehicle unit according to any one of claims 1 through 3, wherein the subject in-vehicle unit includes:

a wide area communicator that communicates with a center installed outside separately via a wide area communication network; and

a self-unit anomaly notification section that notifies, via the wide area communicator, the center of that the control system in the subject in-vehicle unit does not operate normally in response to that the self-unit diagnosis test section determines that the control system does not operate normally.

5. The in-vehicle unit according to claim 4, wherein:

the subject in-vehicle unit includes a position information acquisition instrument that successively acquires position information indicating a current position of the subject vehicle; and

the self-unit anomaly notification section also notifies the center of position information that indicates a current position of the subject vehicle acquired by the position information acquisition instrument, when notifying the center that the control system does not operate normally.

6. The in-vehicle unit according to claim 2 or 3, wherein

the subject in-vehicle unit includes:

a wide area communicator that communicates with a center installed outside separately via a wide area communication network; and

a different-unit anomaly notification section that notifies, via the wide area communicator, the center that the control system in the target nearby in-vehicle unit does not operate normally in response to that the different-unit diagnosis test

section determines that the control system in the target nearby in-vehicle unit does not operate normally.

7. The in-vehicle unit according to claim 6,
wherein:

the in-vehicle unit used in each host vehicle includes a position information acquisition instrument that successively acquires position information indicating a current position of each host vehicle;

the index data-item is transmitted correspondingly with position information acquired by the position information acquisition instrument,
wherein

in the subject in-vehicle unit:

the communication processing section acquires, from the at least one nearby in-vehicle unit, the index data-item transmitted correspondingly with position information indicating a current position; and

the different-unit anomaly notification section also notifies the center of position information indicating a current position of the host vehicle on which the target nearby in-vehicle unit is mounted, when notifying the center that the control system in the target nearby in-vehicle unit does not operate normally.

8. The in-vehicle unit according to any one of claims 1 through 7,
wherein

in the in-vehicle unit used in each host vehicle:

the control system includes

a central processing section to perform a predetermined process,
memory to temporarily store data used in a process performed by
the central processing section, and

a storage as a nonvolatile storage medium to store the data used in
the process performed by the central processing section; and

the index data-item includes the index value corresponding to at least one of

an average usage value of the memory per specified time, an average utilization value of the central processing section per specified time, a free space in the storage, and the number of bad sectors in the storage.

9. The in-vehicle unit according to claim 8,
wherein
in the in-vehicle unit used in each host vehicle,
the index data-item is transmitted correspondingly with version information about software the control system uses,
wherein
in the subject in-vehicle unit:
the communication processing section acquires, from the at least one nearby in-vehicle unit, the index data-item transmitted correspondingly with version information about different-unit software as the software used in the at least one nearby in-vehicle unit; and
the determination criterion specification section specifies the self-unit determination criterion based on the index data-item acquired from the at least one nearby in-vehicle unit that uses the different-unit software whose version is equal to the version information about the software used in the subject in-vehicle unit.

10. An in-vehicle unit that is mounted on each of a plurality of host vehicles including a subject vehicle and at least one nearby vehicle near the subject vehicle, the in-vehicle unit being used in a system to perform inter-vehicle communication,
the in-vehicle unit in each host vehicle, comprising:
a wireless communicator that transmits and receives information using inter-vehicle communication;
a system information acquisition section that acquires information indicating a state of a control system to control operation of the in-vehicle unit in each host vehicle; and
an index data generation section that generates an index data-item including an index value indicating a state of the control system based on the

information acquired by the system information acquisition section, the generated index data-item being transmitted via the wireless communicator,

wherein a subject in-vehicle unit being the in-vehicle unit used in the subject vehicle further includes:

a communication processing section that acquires, via the wireless communicator, an index data-item transmitted from at least one nearby in-vehicle unit being the in-vehicle unit used in the at least one nearby vehicle;

a determination criterion specification section that successively specifies a different-unit determination criterion being a determination criterion to determine whether the control system in a target nearby in-vehicle unit as a predetermined diagnosis target among the at least one nearby in-vehicle operates normally, based on an index data-item acquired by the communication processing section from the at least one nearby in-vehicle unit; and

a different-unit diagnosis test section that determines whether the control system in the target nearby in-vehicle unit operates normally, by comparing the different-unit determination criterion specified by the determination criterion specification section with the index data-item acquired by the communication processing section from the target nearby in-vehicle unit.

11. An in-vehicle unit diagnosis system including a plurality of in-vehicle units respectively provided in a plurality of host vehicles that include a subject vehicle and at least one nearby vehicle near the subject vehicle, the plurality of in-vehicle units performing inter-vehicle communication,

the in-vehicle unit in each host vehicle, comprising:

a wireless communicator that transmits and receives information using inter-vehicle communication;

a system information acquisition section that acquires information indicating a state of a control system to control operation of the in-vehicle unit in each host vehicle; and

an index data generation section that generates an index data-item including an index value indicating a state of the control system based on the

information acquired by the system information acquisition section, the generated index data-item being transmitted via the wireless communicator,

wherein a subject in-vehicle unit being the in-vehicle unit used in the subject vehicle further includes:

a communication processing section that acquires, via the wireless communicator, an index data-item transmitted from at least one nearby in-vehicle unit being the in-vehicle unit used in the at least one nearby vehicle;

a determination criterion specification section that successively specifies a different-unit determination criterion being a determination criterion to determine whether the control system in a target nearby in-vehicle unit as a predetermined diagnosis target among the at least one nearby in-vehicle operates normally, based on an index data-item acquired by the communication processing section from the at least one nearby in-vehicle unit; and

a different-unit diagnosis test section that determines whether the control system in the target nearby in-vehicle unit operates normally, by comparing the different-unit determination criterion specified by the determination criterion specification section with the index data-item acquired by the communication processing section from the target nearby in-vehicle unit.