CLAIMS

1. An in-vehicle unit used in each of a plurality of host vehicles, the host vehicles including a subject vehicle and a plurality of nearby vehicles near the subject vehicle,

the in-vehicle unit performing inter-vehicle communication,

each in-vehicle unit comprising:

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

a sensor instrument that detects a predetermined physical state quantity acting on each in-vehicle unit; and

an index data generation section that generates an index data-item including an index value indicating an operational situation of the sensor instrument based on a detection result from the sensor instrument, the generated index data-item being transmitted via the wireless communicator,

a subject in-vehicle unit that serves as the in-vehicle unit used in the subject vehicle, the subject in-vehicle unit further comprising:

a communication processing section that makes the wireless communicator acquire a different-unit index data-item as the index data-item transmitted from a plurality of nearby in-vehicle units as the in-vehicle units in the nearby vehicles;

a determination criterion specification section that successively specifies a different-unit determination criterion as a determination criterion to determine whether a different sensor instrument as the sensor instrument included in a target nearby in-vehicle unit operates normally, based on the different-unit index data-item acquired by the communication processing section,

the target nearby in-vehicle unit serving as a predetermined diagnosis target among the nearby in-vehicle units; and

a different-unit diagnosis test section that determines whether the different sensor instrument 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 different-unit index data-item acquired by the communication processing section from the target nearby

in-vehicle unit.

2. An in-vehicle unit used in each of a plurality of host vehicles, the host vehicles including a subject vehicle and at least one nearby vehicle near the subject vehicle, the in-vehicle unit performing inter-vehicle communication,

each in-vehicle unit comprising:

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

a sensor instrument that detects a predetermined physical state quantity acting on each in-vehicle unit on each host vehicle that is under a dynamically varying exterior environment; and

an index data generation section that generates an index data-item,

the index data-item indicating an operational situation of the sensor instrument and being determined based on the predetermined physical state quantity acting on each in-vehicle unit detected by the sensor instrument,

the generated index data-item being transmitted via the wireless communicator,

a subject in-vehicle unit that serves as the in-vehicle unit used in the subject vehicle, the subject in-vehicle unit further comprising:

a communication processing section that makes the wireless communicator acquire a different-unit index data-item as the index data-item transmitted from at least one nearby in-vehicle unit as the in-vehicle unit in the at least one nearby vehicle;

a determination criterion specification section that successively specifies a self-unit determination criterion as a determination criterion to determine whether the sensor instrument in the subject in-vehicle unit operates normally, based on the different-unit index data-item on the nearby vehicle, which is under an exterior environment similar to an exterior environment of the subject vehicle,

the different-unit index data-item on the nearby vehicle under the exterior environment similar to the exterior environment of the subject vehicle being extracted from the different-unit index data-item on the at least

one nearby vehicle acquired by the communication processing section; and

a self-unit diagnosis test section that determines whether the sensor instrument in the subject in-vehicle unit operates normally, by comparing the self-unit determination criterion specified by the determination criterion specification section with a self-unit index data-item as the index data-item in the subject in-vehicle unit, without using information about the exterior environment of each of the subject vehicle and the at least one nearby vehicle.

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

wherein:

the subject in-vehicle unit includes the determination criterion specification section successively that specifies a different-unit determination criterion as a determination criterion to determine whether a different sensor instrument as the sensor instrument included in a target nearby in-vehicle unit operates normally, based on the different-unit index data-item acquired by the communication processing section,

the target nearby in-vehicle unit serving as a predetermined diagnosis target among the at least one nearby in-vehicle unit; and

the subject in-vehicle unit further includes a different-unit diagnosis test section that determines whether the different sensor instrument 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 different-unit index data-item acquired by the communication processing section from the target nearby in-vehicle unit.

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

wherein

the subject in-vehicle unit includes:

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

a different-unit anomaly notification section that makes the wide area communicator notify the center that the different sensor instrument in the target nearby in-vehicle unit does not operate normally in response to the different-unit diagnosis test section determining that the different sensor instrument in the target nearby in-vehicle unit does not operate normally.

5. The in-vehicle unit according to claim 3 or 4,

wherein

the in-vehicle unit used in each host vehicle further includes

a position information output interface that detects a current position of each in-vehicle unit itself and successively outputs position information indicating a

detected current position,

the outputted position information including height information indicating a height at which each in-vehicle unit is positioned with reference to a predetermined reference level,

the outputted position information being transmitted to be associated with the index data-item, when the index data-item is transmitted via the wireless communicator,

wherein

in the subject in-vehicle unit:

the communication processing section acquires the different-unit index data-item that is transmitted from the at least one nearby in-vehicle unit and is associated with position information indicating the current position; and

the determination criterion specification section specifies the different-unit determination criterion based on the different-unit index data-item acquired from the at least one nearby in-vehicle unit that is positioned at a height equal to a height at which the target nearby in-vehicle unit is positioned.

6. The in-vehicle unit according to any one of claims 2 through 5,

wherein the subject in-vehicle unit includes:

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

a self-terminal anomaly notification section that makes the wide area communicator notify the center that the sensor instrument in the subject in-vehicle unit does not operate normally in response to the self-unit diagnosis test section determining that the sensor instrument does not operate normally.

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

wherein

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

the sensor instrument includes an acceleration sensor that detects an acceleration acting on each of three axis directions orthogonal to each other; and

the index data-item includes an acceleration detected by the acceleration sensor in each axis direction;

wherein

in the subject in-vehicle unit:

the determination criterion specification section specifies a determination criterion that determines whether the subject in-vehicle unit itself is attached to the subject vehicle according to a predetermined posture, based on an acceleration in each axis direction included in the different-unit index data-item acquired from the at least one nearby in-vehicle unit;

the self-unit diagnosis test section determines whether the subject in-vehicle unit itself is attached to the subject vehicle according to a predetermined posture, by comparing the determination criterion specified by the determination criterion specification section with the acceleration in each axis direction included in the index data-item; and

the self-terminal anomaly notification section makes the wide area communicator notify the center that the subject in-vehicle unit is not attached to the subject vehicle according to a predetermined posture in response to the self-unit diagnosis test section determining that the subject in-vehicle unit itself is not

attached to the subject vehicle according to the predetermined posture.

8. The in-vehicle unit according to any one of claims 2 through 7,

wherein each in-vehicle unit used in each host vehicle includes

a position information output interface that detects a current position of each in-vehicle unit itself and successively outputs position information indicating a detected current position,

the outputted position information including height information indicating a height at which each in-vehicle unit itself is positioned with reference to a predetermined reference level,

the outputted position information being transmitted to be associated with the index data-item, when the index data-item is transmitted,

wherein in the subject in-vehicle unit:

the communication processing section acquires the different-unit index data-item that is transmitted from the at least one nearby in-vehicle unit and is associated with position information indicating the current position; and

the determination criterion specification section specifies the self-unit determination criterion based on the different-unit index data-item acquired from the at least one nearby in-vehicle unit positioned at a height equal to a height at which the subject in-vehicle unit is positioned.

9. The in-vehicle unit according to claim 2, wherein

the exterior environment includes at least one of a surface shape of a road, a road shape (curvature), a road gradient, a period of day, and weather.

10. The in-vehicle unit according to claim 2, wherein

the sensor instrument detecting the physical state quantity acting on the in-vehicle unit includes at least either an acceleration sensor or a gyro sensor.

11. The in-vehicle unit according to claim 2, wherein

the sensor instrument detecting the physical state quantity acting on the

in-vehicle unit includes an illuminance sensor.

12. The in-vehicle unit according to claim 2, wherein

the index data-item includes data in statistics of the physical state quantity that is any one of a maximum, a median, a minimum, an average value, a dispersion, a standard deviation, and an integral value.

13. The in-vehicle unit according to claim 2, wherein

the index data-item includes either an output interval or a last output time.

14. An in-vehicle diagnosis system having 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,

each in-vehicle unit comprising:

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

a sensor instrument that detects a predetermined physical state quantity acting on each in-vehicle unit;

an index data generation section that generates an index data-item including an index value indicating an operational situation of the sensor instrument based on a detection result from the sensor instrument;

a communication processing section that makes the wireless communicator

transmit the generated index data-item and

acquire a different-unit index data-item as the index data-item transmitted from at least one nearby in-vehicle unit as the in-vehicle unit in the at least one nearby vehicle;

a determination criterion specification section that successively specifies a different-unit determination criterion as a determination criterion to determine whether a different sensor instrument as the sensor instrument included in a target nearby in-vehicle unit operates normally, based on the different-unit index data-item acquired by the communication processing section,

the target nearby in-vehicle unit serving as a predetermined diagnosis target among the at least one nearby in-vehicle unit; and

a different-unit diagnosis test section that determines whether the different sensor instrument 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 different-unit index data-item acquired by the communication processing section from the target nearby in-vehicle unit.

15. An in-vehicle unit used in each of a plurality of host vehicles, the host vehicles including a subject vehicle and at least one nearby vehicle near the subject vehicle, the in-vehicle unit performing inter-vehicle communication,

each in-vehicle unit comprising:

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

a sensor instrument that detects a predetermined physical state quantity acting on each in-vehicle unit; and

an index data generation section that generates an index data-item including an index value indicating an operational situation of the sensor instrument based on a detection result from the sensor instrument, the generated index data-item being transmitted via the wireless communicator,

a subject in-vehicle unit that serves as the in-vehicle unit used in the subject vehicle, the subject in-vehicle unit further comprising:

a communication processing section that makes the wireless communicator acquire a different-unit index data-item as the index data-item transmitted from at least one nearby in-vehicle unit as the in-vehicle unit in the at least one nearby vehicle;

a determination criterion specification section that successively specifies a self-unit determination criterion as a determination criterion to determine whether the sensor instrument in the subject in-vehicle unit operates normally,

based on the different-unit index data-item acquired by the communication processing section; and

a self-unit diagnosis test section that determines whether the sensor instrument in the subject in-vehicle unit operates normally, by comparing the self-unit determination criterion specified by the determination criterion specification section with a self-unit index data-item as the index data-item in the subject in-vehicle unit,

wherein:

the subject in-vehicle unit includes the determination criterion specification section successively that specifies a different-unit determination criterion as a determination criterion to determine whether a different sensor instrument as the sensor instrument included in a target nearby in-vehicle unit operates normally, based on the different-unit index data-item acquired by the communication processing section,

the target nearby in-vehicle unit serving as a predetermined diagnosis target among the at least one nearby in-vehicle unit; and

the subject in-vehicle unit further includes a different-unit diagnosis test section that determines whether the different sensor instrument 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 different-unit index data-item acquired by the communication processing section from the target nearby in-vehicle unit.

16. The in-vehicle unit according to claim 15,

wherein

the subject in-vehicle unit includes:

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

a different-unit anomaly notification section that makes the wide area communicator notify the center that the different sensor instrument in the target

nearby in-vehicle unit does not operate normally in response to the different-unit diagnosis test section determining that the different sensor instrument in the target nearby in-vehicle unit does not operate normally.

17. The in-vehicle unit according to claim 16,

wherein

the in-vehicle unit used in each host vehicle further includes

a position information output interface that detects a current position of each in-vehicle unit itself and successively outputs position information indicating a detected current position,

the outputted position information including height information indicating a height at which each in-vehicle unit is positioned with reference to a predetermined reference level,

the outputted position information being transmitted to be associated with the index data-item, when the index data-item is transmitted via the wireless communicator,

wherein

in the subject in-vehicle unit:

the communication processing section acquires the different-unit index data-item that is transmitted from the at least one nearby in-vehicle unit and is associated with position information indicating the current position; and

the determination criterion specification section specifies the different-unit determination criterion based on the different-unit index data-item acquired from the at least one nearby in-vehicle unit that is positioned at a height equal to a height at which the target nearby in-vehicle unit is positioned.

18. An in-vehicle unit used in each of a plurality of host vehicles, the host vehicles including a subject vehicle and at least one nearby vehicle near the subject vehicle, the in-vehicle unit performing inter-vehicle communication,

each in-vehicle unit comprising:

a wireless communicator that transmits and receives information using

inter-vehicle communication;

a sensor instrument that detects a predetermined physical state quantity acting on each in-vehicle unit; and

an index data generation section that generates an index data-item including an index value indicating an operational situation of the sensor instrument based on a detection result from the sensor instrument, the generated index data-item being transmitted via the wireless communicator,

a subject in-vehicle unit that serves as the in-vehicle unit used in the subject vehicle, the subject in-vehicle unit further comprising:

a communication processing section that makes the wireless communicator acquire a different-unit index data-item as the index data-item transmitted from at least one nearby in-vehicle unit as the in-vehicle unit in the at least one nearby vehicle;

a determination criterion specification section that successively specifies a self-unit determination criterion as a determination criterion to determine whether the sensor instrument in the subject in-vehicle unit operates normally, based on the different-unit index data-item acquired by the communication processing section; and

a self-unit diagnosis test section that determines whether the sensor instrument in the subject in-vehicle unit operates normally, by comparing the self-unit determination criterion specified by the determination criterion specification section with a self-unit index data-item as the index data-item in the subject in-vehicle unit,

wherein the subject in-vehicle unit includes:

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

a self-terminal anomaly notification section that makes the wide area communicator notify the center that the sensor instrument in the subject in-vehicle unit does not operate normally in response to the self-unit diagnosis test section determining that the sensor instrument does not operate normally,

wherein

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

the sensor instrument includes an acceleration sensor that detects an acceleration acting on each of three axis directions orthogonal to each other; and

the index data-item includes an acceleration detected by the acceleration sensor in each axis direction;

wherein

in the subject in-vehicle unit:

the determination criterion specification section specifies a determination criterion that determines whether the subject in-vehicle unit itself is attached to the subject vehicle according to a predetermined posture, based on an acceleration in each axis direction included in the different-unit index data-item acquired from the at least one nearby in-vehicle unit;

the self-unit diagnosis test section determines whether the subject in-vehicle unit itself is attached to the subject vehicle according to a predetermined posture, by comparing the determination criterion specified by the determination criterion specification section with the acceleration in each axis direction included in the index data-item; and

the self-terminal anomaly notification section makes the wide area communicator notify the center that the subject in-vehicle unit is not attached to the subject vehicle according to a predetermined posture in response to the self-unit diagnosis test section determining that the subject in-vehicle unit itself is not attached to the subject vehicle according to the predetermined posture.

19. An in-vehicle unit used in each of a plurality of host vehicles, the host vehicles including a subject vehicle and at least one nearby vehicle near the subject vehicle, the in-vehicle unit performing inter-vehicle communication,

each in-vehicle unit comprising:

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

a sensor instrument that detects a predetermined physical state quantity acting on each in-vehicle unit; and

an index data generation section that generates an index data-item including an index value indicating an operational situation of the sensor instrument based on a detection result from the sensor instrument, the generated index data-item being transmitted via the wireless communicator,

a subject in-vehicle unit that serves as the in-vehicle unit used in the subject vehicle, the subject in-vehicle unit further comprising:

a communication processing section that makes the wireless communicator acquire a different-unit index data-item as the index data-item transmitted from at least one nearby in-vehicle unit as the in-vehicle unit in the at least one nearby vehicle;

a determination criterion specification section that successively specifies a self-unit determination criterion as a determination criterion to determine whether the sensor instrument in the subject in-vehicle unit operates normally, based on the different-unit index data-item acquired by the communication processing section; and

a self-unit diagnosis test section that determines whether the sensor instrument in the subject in-vehicle unit operates normally, by comparing the self-unit determination criterion specified by the determination criterion specification section with a self-unit index data-item as the index data-item in the subject in-vehicle unit,

wherein each in-vehicle unit used in each host vehicle includes

a position information output interface that detects a current position of each in-vehicle unit itself and successively outputs position information indicating a detected current position,

the outputted position information including height information indicating a height at which each in-vehicle unit itself is positioned with reference to a predetermined reference level,

the outputted position information being transmitted to be associated with the index data-item, when the index data-item is transmitted,

wherein in the subject in-vehicle unit:

the communication processing section acquires the different-unit index

data-item that is transmitted from the at least one nearby in-vehicle unit and is associated with position information indicating the current position; and

the determination criterion specification section specifies the self-unit determination criterion based on the different-unit index data-item acquired from the at least one nearby in-vehicle unit positioned at a height equal to a height at which the subject in-vehicle unit is positioned.