

SPECIFICATION

TITLE OF INVENTION: VEHICLE INFORMATION TERMINAL

5 CROSS REFERENCE TO RELATED APPLICATIONS

[0001]

This application is based on and incorporates herein by reference Japanese Patent Application No. 2017-2071 filed on January 10, 2017.

10 TECHNICAL FIELD

[0002]

The present disclosure relates to a vehicle information terminal as an information processing terminal attached to a vehicle after shipment from a factory by a user or the like.

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BACKGROUND ART

[0003]

An information processing terminal including a display and an input device (hereinafter referred to as a vehicle information terminal) may be attached to a vehicle after shipment from a factory by a user or the like. Such a vehicle information terminal may include, for example, a portable type navigation apparatus (hereinafter referred to as a portable navigation apparatus).

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[0004]

Patent Literature 1 discloses a configuration including a fixing portion for attaching the portable navigation apparatus to a dashboard of a vehicle, a main case in which a display, a circuit board, and the like are accommodated, and a support post (hereinafter referred to as an arm) for connecting the fixed portion and a housing.

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PRIOR ART LITERATURES

PATENT LITERATURE

[0005]

Patent Literature 1: JP 2008-239003 A

5 SUMMARY OF THE INVENTION

[0006]

When a new function is added to a vehicle information terminal, the number of circuits to be mounted on the circuit board increases, so that the circuit board increases in size, resulting in a problem that the main case also increases in size. As one configuration for solving such a problem, a configuration (hereinafter, assumed configuration) is conceivable in which a circuit board providing a part of a function to be provided by the vehicle information terminal is disposed in a case (hereinafter referred to a holder case) which also functions as the fixing portion, and the circuit board accommodated in the main case and the circuit board accommodated in the holder case are connected to each other by a communication cable.

[0007]

In the assumed configuration, the main case and the holder case are connected to each other by a cylindrical configuration (hereinafter referred to as an arm) for supporting an orientation (attitude) of the main case with respect to the holder case. In addition, the communication cable connecting the two circuit boards is accommodated in the cylindrical arm, thereby being capable of protecting the communication cable and making an appearance clear.

25 [0008]

However, in the supposed configuration as described above, there is a concern that the communication cable comes into contact with an inner surface of the arm due to vehicle body vibration caused by the traveling of the vehicle or the like to generate an unpleasant abnormal sound (for example, a hitting sound or the like).

[0009]

The present disclosure has been made on the basis of the above situation, and an object of the present is to provide a vehicle information terminal capable of compatibly downsizing a main case and reducing the generation of abnormal noise caused by vehicle body vibration.

5 [0010]

According to the present disclosure, a vehicle information terminal includes a display that displays information directed to an occupant seated in a driver's seat of a vehicle, a first housing that accommodates the display and a first substrate on which a circuit providing a predetermined first function is
10 mounted, a second housing that accommodates a second substrate on which a circuit providing a second function is mounted, the second function being different from the first function, an arm that connects the first housing to the second housing and that supports an orientation of the first housing relative to the second housing, and a cable that connects the first substrate to the second
15 substrate, wherein the first housing has a first hole through which the cable passes, the second housing has a second hole through which the cable passes, the arm includes a hollow portion which communicates the first hole with the second hole, the cable is disposed to pass through the hollow portion as an inner space of the arm and to abut against a predetermined abutment region of
20 an inner surface portion of the arm, and a buffer member which is elastically deformable is attached to the abutment region.

[0011]

In the configuration described above, the cable is disposed so as to abut against the buffer member provided on the inner surface portion of the arm.
25 This makes it possible to reduce the possibility that the cable comes into contact with an inner surface of the arm to generate an unpleasant abnormal sound (for example, a hitting sound), due to the vehicle body vibration caused by the travel of the vehicle or the like.

[0012]

30 Further, not only the first substrate accommodated in the first housing but also the second substrate accommodated in the second housing can be

used to implement the function to be provided in the vehicle information terminal. Therefore, the first housing as the main case can be reduced in size as compared with a configuration in which a function to be provided in the vehicle information terminal is mounted with the use of only one circuit board.

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BRIEF DESCRIPTION OF DRAWINGS

[0013]

FIG. 1 is a diagram showing an example of mounting a portable navigation apparatus 100 to a vehicle.

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FIG. 2 is a diagram conceptually showing an internal structure of the portable navigation apparatus 100 when viewed from a side.

FIG. 3 is a block diagram showing a schematic configuration of the portable navigation apparatus 100.

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FIG. 4 is an external perspective view of a state in which the portable navigation apparatus 100 is attached to a vehicle attachment bracket 300.

FIG. 5 is a diagram illustrating a state in which a flexible cable 4 is undulated.

FIG. 6 is a cross-sectional view of a portion where a buffer member 9 is provided in an arm 3.

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FIG. 7 is a diagram of a configuration shown in FIG. 6 when viewed from another viewpoint.

FIG. 8 is a diagram illustrating an example of a method of determining an abutment region in the arm 3.

FIG. 9 is a diagram showing a configuration of the arm 3 in Modification 1.

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FIG. 10 is a diagram showing an example of mounting the portable navigation apparatus 100 to the vehicle.

FIG. 11 is a diagram showing a schematic configuration of the portable navigation apparatus 100 mounted on a dashboard 400 in use.

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FIG. 12 is a diagram showing a configuration of the portable navigation apparatus 100 mounted on a bar type handlebar in use.

DESCRIPTION OF EMBODIMENTS

[0014]

Hereinafter, a portable navigation apparatus 100 to which the present disclosure is applied will be described with reference to the drawings as an example of an embodiment of the present disclosure. FIG. 1 is a diagram showing an example of a state in which a portable navigation apparatus 100 is attached to a vehicle. The portable navigation apparatus 100 is attached to a front windshield 200 or the like of a vehicle so that a display surface 51 of a display 5, which will be described later, faces a driver's seat in use.

[0015]

<Functions of Portable Navigation Apparatus 100>

Before describing a configuration of the portable navigation apparatus 100, various functions of the portable navigation apparatus 100 will be described schematically. The portable navigation apparatus 100 is a device having a function as a well-known navigation apparatus for performing route guidance and the like (hereinafter, referred to as a navigation function). In addition, the portable navigation apparatus 100 has a function (hereinafter, referred to as a GNSS function) of measuring the current position based on a navigation signal transmitted from positioning satellites used in a GNSS (Global Navigation Satellite System) as a sub-function for realizing the navigation function. Examples of the GNSS include a GPS (Global Positioning System), a Galileo, and a GLONASS.

[0016]

The portable navigation apparatus 100 includes a wide area communication function and a short range communication function in addition to the navigation function and the GNSS function. The wide area communication function is a function of wirelessly accessing a wide area communication network such as a cellular phone network and performing a communication with a communication device (for example, a center) existing outside the vehicle. For convenience, a communication over a wide area

communication network is referred to as wide area communication in order to distinguish the communication from communication based on another method. As a communication method for realizing wide area communication, an arbitrary mobile communication method can be adopted. In this example, as an example, it is assumed that the portable navigation apparatus 100 performs the wide area communication in accordance with an LTE standard.

[0017]

The short range communication function is a function of performing a wireless communication with equipment (hereinafter, referred to as "roadside device") or the like placed on a road, without using a wireless base station or the like (that is, directly), in accordance with a predetermined communication method. As a communication method for realizing the narrow area communication function, for example, a DSRC (Dedicated Short Range Communications) based on a wireless LAN technique, a WAVE (Wireless Access in Vehicular Environment) standard disclosed in the IEEE1609, or the like can be adopted. In this example, it is assumed that the portable navigation apparatus 100 is configured to communicate with the roadside device or the like with the use of the DSRC.

[0018]

The roadside device is installed above the road (for example, at a position where a height from a road surface is 6 m) so as to distribute information to a limited area on the road. In other words, the roadside device is a communication device disposed at a position higher than a roof of the vehicle. The information distributed by the roadside device includes, for example, road traffic information such as traffic congestion and accidents, and safe driving support information. As another aspect, the roadside device may be a communication equipment that is provided at an entrance of a toll road and that configures an automatic toll collection system that performs a settlement process of a toll road usage fee. The short range communication function may perform a communication with a communication device that provides a narrow area communication function mounted on another vehicle. In other words, the

short range communication function may provide a vehicle-to-vehicle communication.

[0019]

<Configuration of Portable Navigation Apparatus 100>

5 Next, an example of the configuration of the portable navigation apparatus 100 for realizing the various functions described above will be described. As shown in FIGS. 2 and 3, the portable navigation apparatus 100 includes two cases of a main case 1 and a holder case 2, which are connected to each other by an arm 3. The arm 3 is an arcuately curved cylindrical member, and is configured to allow a flexible cable 4 to pass through the arm 3. For
10 convenience, a direction from the main case 1 toward the holder case 2 is referred to as a depth direction. An arrow in FIG. 2 indicates a depth direction. The main case 1 corresponds to a first housing, and the holder case 2 corresponds to a second housing.

15 [0020]

 The main case 1 accommodates a display 5, a touch panel 6 laminated on a display surface 51 of the display 5, and a first substrate 7 which is a printed circuit board on which various electronic components are disposed. The holder case 2 accommodates a second substrate 8, which is a printed circuit board on
20 which various electronic components are mounted. The first substrate 7 and the second substrate 8 are connected to each other by the flexible cable 4.

[0021]

 As described above, the portable navigation apparatus 100 is a device on the premise that the display surface 51 of the display 5 is disposed so as to
25 face a driver's seat. Therefore, the portable navigation apparatus 100 is set up vertically and horizontally so as to correspond to a display direction of the display 5. A left-right direction and an up-down direction for the portable navigation apparatus 100 correspond to a left-right direction and an up-down direction for the main case 1.

30 [0022]

 The portable navigation apparatus 100 according to the present

embodiment is configured on the assumption that the portable navigation apparatus 100 is mounted on the vehicle so that the left-right direction of the main case 1 is parallel to a horizontal plane (hereinafter referred to as a horizontal plane of the vehicle) for the vehicle and that the up-down direction coincides with the height direction of the vehicle. A state indicated by the coincidence in the present specification is not limited to a perfect coincidence. The above state also includes a state in which a person seated in the driver's seat is inclined to such an extent that the person can recognize a display content of the display 5 without feeling uncomfortable. The vehicle horizontal plane is a plane perpendicular to the height direction of the vehicle.

[0023]

The portable navigation apparatus 100 may be attached to the vehicle through a vehicle attachment bracket 300 attached to the front windshield 200 with double-sided tape or the like, for example. The vehicle attachment bracket 300 is a member for holding the portable navigation apparatus 100. When the holder case 2 is mounted on the vehicle attachment bracket 300, the portable navigation apparatus 100 is locked to the vehicle. FIG. 4 is an external perspective view of a state in which the portable navigation apparatus 100 and the vehicle attachment bracket 300 are integrated with each other.

[0024]

The mounting position of the portable navigation apparatus 100 on the front windshield 200 may be determined by a user. The portable navigation apparatus 100 is preferably disposed in a peripheral field of view, in particular, in an effective field of view in a state in which an occupant in the driver's seat is looking toward a front of the vehicle. The portable navigation apparatus 100 according to the present embodiment is configured on the assumption that the portable navigation apparatus 100 is mounted at the same height as that of an eye of the occupant in the driver's seat in use.

[0025]

A shape of the main case 1 may be appropriately designed. In this configuration, as an example, it is assumed that the main case 1 is formed in a

flat rectangular parallelepiped shape having a thickness direction in a direction perpendicular to the first substrate 7. The thickness of the main case 1 needs only to be large enough to accommodate a predetermined accommodation object such as the display 5, the touch panel 6, the first substrate 7, and the like.

5 A thickness direction corresponds to the depth direction described above. In addition, in the main case 1, a plane parallel to the first substrate 7 is formed in a rectangular shape having a length in the left-right direction longer than a length in the up-down direction.

[0026]

10 The shape of the holder case 2 may also be appropriately designed. In this case, as an example, it is assumed that the holder case 2 is formed in a flat rectangular parallelepiped shape having a second substrate orthogonal direction 8 as the thickness direction. A thickness of the holder case 2 needs only to be large enough to accommodate the second substrate 8 on which
15 various electronic components are mounted.

[0027]

Reference numeral 21 shown in FIG. 2 denotes a surface (hereinafter, a holder upper surface portion) facing relatively upward in the holder case 2 when the portable navigation apparatus 100 is mounted on the vehicle in a
20 correct orientation. In this example, the correct mounting orientation is a mounting orientation assumed at the time of designing the portable navigation apparatus 100, and is a posture in which a display facing direction (that is, up and down) of the display 5 is correct and the display surface 51 of the display 5 is directed toward the driver's seat. Specific configurations of the main case 1,
25 the holder case 2, and the arm 3 will be described later.

[0028]

<Containment in Main Case 1>

Now, various configurations accommodated in the main case 1 will be described. The display 5 is a display device having the display surface 51 for
30 displaying various information. The display surface 51 of the display 5 is formed in a rectangular shape. Accordingly, an appearance shape of the display 5 is

also a flat rectangular parallelepiped shape. For convenience, in the display 5, a surface opposite to the display surface 51 is referred to as a back surface portion. As described above, the portion of the main case 1 where the display surface 51 of the display 5 is disposed is an opening portion, and the display 5 is accommodated in the main case 1 so that the display surface 51 can be seen from the outside.

[0029]

As the display 5, a liquid crystal display, an organic EL display, or the like can be used. It is assumed in this example that the display 5 is implemented with the use of an LCD (Liquid Crystal Display) module. The display 5 is driven based on a control signal from a display controller, which will be described later, to display an image.

[0030]

The touch panel 6 is, for example, a capacitive type touch panel, and is stacked on the display surface 51 of the display 5. The touch panel 6 sequentially outputs a signal indicating whether or not the touch panel 6 is touched by the user and, if touched, a touch position (hereinafter, referred to as a touch position signal) to a touch panel controller 72.

[0031]

The touch panel 6 may be a touch panel that detects the touch position of the user by a method other than an electrostatic capacitance method (for example, a pressure sensitive method). Although a configuration in which the touch panel 6 is employed as a device (that is, an input device) for the user to input an instruction to the portable navigation apparatus 100 is disclosed in this example, the present invention is not limited to that example. Known devices such as a hardware switch, mouse, and a haptic device may be employed as input devices.

[0032]

The first substrate 7 is formed in a substantially rectangular shape. The first substrate 7 is accommodated in the main case 1 in an orientation facing the back surface portion of the display 5. A circuit module mounted on the first

substrate 7 may be appropriately designed to provide a desired function. In this case, as an example, it is assumed that a display controller 71, a touch panel controller 72, a main control unit 73, a power supply circuit 74, and a main side connector 75 are disposed on the first substrate 7. Positions at which the display controller 71, the touch panel controller 72, the main control unit 73, the power supply circuit 74, and the main side connector 75 are placed on the first substrate 7 may be appropriately designed.

[0033]

The display controller 71 is a component for controlling the operation of the display 5. The display controller 71 is connected to the display 5 by a cable (not shown) so as to be able to communicate with each other. The display controller 71 is also connected to the main control unit 73 so as to be able to communicate with each other. The display controller 71 generates a control signal based on display data input from the main control unit 73 and outputs the control signal to the display 5 to display an image corresponding to the display data.

[0034]

The touch panel controller 72 is a component for controlling the operation of the touch panel 6. The touch panel controller 72 is connected to the touch panel 6 by a cable (not shown) so as to be able to communicate with each other. The touch panel controller 72 is also connected to the main control unit 73 so as to be able to communicate with each other. The touch panel controller 72 converts the touch position signal output from the touch panel 6 into data in a format recognizable by the main control unit 73, and provides the data to the main control unit 73.

[0035]

The main control unit 73 is configured as a computer including a CPU 731 as a central processing unit, a RAM 732 as a volatile memory, and a ROM 733 as a nonvolatile memory. Various programs for causing a normal computer to function as the main control unit 73 are stored in the ROM 733.

[0036]

The main control unit 73 provides a navigation function by the CPU 731 executing programs stored in the ROM 733. In addition, the main control unit 73 creates display data to be displayed on the display 5 based on the data input from the touch panel controller 72 or the like and the above programs, and outputs the display data to the display controller 71. In addition, the main control unit 73 controls the power on/off of the portable navigation apparatus 100 in cooperation with the power supply circuit 74, which will be described later.

[0037]

The power supply circuit 74 is a circuit that converts a power supply voltage supplied from a power supply (not shown) into an operating voltage suitable for the operation of each unit of the portable navigation apparatus 100. The operation voltage generated by the power supply circuit 74 is supplied to each unit. The power supply may be a battery built in the portable navigation apparatus 100, or may be a vehicle-mounted battery. When the vehicle-mounted battery is used as a power supply of the portable navigation apparatus 100, it is assumed that the portable navigation apparatus 100 is connected to the vehicle-mounted battery by a power cable (not shown).

[0038]

The main side connector 75 is a connector for electrically connecting the flexible cable 4 and the first substrate 7. In other words, the first substrate 7 is connected to one end of the flexible cable 4 through the main side connector 75. The other end of the flexible cable 4 is electrically connected to the second substrate 8 through a holder side connector 87.

[0039]

The main side connector 75 is disposed at a position facing a draw-out hole 14 to be described later in the first substrate 7. A position of the first substrate 7 where the main side connector 75 is disposed corresponds to a first substrate side connection point. A plane orthogonal to the left-right direction of the main case 1 through the main side connector 75 corresponds to a center plane. Hereinafter, when the main side connector 75 and the holder side

connector 87 are not distinguished from each other, those connectors are referred to as connectors.

[0040]

The function provided by the circuit module mounted on the first substrate 7 corresponds to a first function. Specifically, a function of controlling the display of the display 5 based on a user operation on the touch panel 6, a power supply control function, a function of performing calculation processing using data provided from various communication modules, which will be described later, and the like correspond to a first function.

[0041]

<Configuration of Second Substrate 8>

Now, the configuration of the second substrate 8 accommodated in the holder case 2 will be described. The second substrate 8 is formed in a substantially rectangular shape, and is accommodated in the holder case 2 so as to face the holder upper surface portion 21. The second substrate 8 includes an upper surface 8A facing relatively upward when the main case 1 is disposed in a correct orientation and a lower surface 8B facing relatively downward.

[0042]

The electronic components mounted on the second substrate 8 may be appropriately designed. In this example, it is assumed that a GNSS antenna 81, a GNSS module 82, a DSRC antenna 83, a DSRC module 84, an LTE antenna 85, an LTE module 86, and a holder side connector 87 are disposed on the second substrate 8.

[0043]

The GNSS antenna 81 is an antenna for receiving a navigation signal transmitted by a positioning satellite (hereinafter referred to as a GNSS satellite) of the GNSS. For example, the GNSS antenna 81 may be an antenna that receives a circularly polarized wave in a 1.5 GHz band. The GNSS antenna 81 is electrically connected to the GNSS module 82, and outputs an electric signal corresponding to a received radio wave.

[0044]

The GNSS antenna 81 is disposed on the upper surface 8A so that the center of directivity is oriented in a direction from the lower surface 8B toward the upper surface 8A (hereinafter referred to as a second substrate orthogonal direction). A state in which the center of the directivity is oriented in the second substrate orthogonal direction is not limited to a state in which the center of the directivity completely coincides with the second substrate orthogonal direction. The center of the directivity may be shifted by about 45 degrees from the second substrate orthogonal direction.

[0045]

The GNSS module 82 perform calculation processing such as measurement of the current position based on a signal received by the GNSS antenna 81. The GNSS module 82 is connected to the holder side connector 87. As a result, the GNSS module 82 is connected to the main control unit 73 through the holder side connector 87, the flexible cable 4, and the like so as to be able to communicate with each other. A location where the GNSS module 82 is installed on the second substrate 8 may be appropriately designed. For example, the GNSS module 82 may be located in the vicinity of a position corresponding to a rear side of the GNSS antenna 81 in the lower surface 8B. The GNSS antenna 81 and the GNSS module 82 are configured to realize the GNSS function described above.

[0046]

The DSRC antenna 83 is an antenna for transmitting and receiving radio waves in a frequency band (e.g., 5.8 GHz band) adopted as a carrier wave in the DSRC. The DSRC antenna 83 is provided so that the center of directivity faces the second substrate orthogonal direction on the upper surface 8A. The DSRC antenna 83 is electrically connected to the DSRC module 84.

[0047]

The DSRC module 84 is connected to the main control unit 73 through the holder side connector 87, the flexible cable 4, and the like. The DSRC module 84 demodulates a signal received by the DSRC antenna 83 and provides the demodulated signal to the main control unit 73. The DSRC module 84

modulates the data inputted from the main control unit 73, outputs the modulated data to the DSRC antenna 83, and radiates the modulated data as radio waves. A location where the DSRC module 84 is installed on the second substrate 8 may be appropriately designed. For example, the DSRC module 84
5 may be disposed in the vicinity of a position corresponding to the rear side of the DSRC antenna 83 on the lower surface 8B. The DSRC antenna 83 and the DSRC module 84 are configured to realize the short range communication function described above.

[0048]

10 The LTE antenna 85 is an antenna for transmitting and receiving a radio wave in a frequency band adopted as a carrier wave in the LTE standard. The LTE antenna 85 is provided so that the center of directivity is oriented in the second substrate orthogonal direction on the upper surface 8A. The LTE antenna 85 is electrically connected to the LTE module 86.

15 [0049]

The LTE module 86 is connected to the main control unit 73 through the holder side connector 87, the flexible cable 4, and the like. The LTE module 86 demodulates a signal received by the LTE antenna 85 and provides the demodulated signal to the main control unit 73. In addition, the LTE module 86
20 modulates the data input from the main control unit 73, outputs the modulated data to the LTE antenna 85, and radiates the modulated data as a radio wave. A location where the LTE module 86 is installed on the second substrate 8 may be appropriately designed. For example, the LTE module 86 may be located in the vicinity of a position corresponding to a rear side of the LTE antenna 85 on the
25 lower surface 8B.

[0050]

The holder side connector 87 is a connector for electrically connecting the flexible cable 4 and the second substrate 8. In other words, the second substrate 8 is connected to one end of the flexible cable 4 through the holder
30 side connector 87. As a result, the second substrate 8 and the first substrate 7 are electrically connected to each other. The holder side connector 87 is

disposed on the lower surface 8B at a position facing the draw-out hole 24 provided in a holder lower surface portion 22. The holder side connector 87, the draw-out hole 24, the draw-out hole 14, and the main side connector 75 are provided at positions in the same plane when an angle adjustment amount of the main case 1 is set to 0 degrees. A position at which the holder side connector 87 is disposed on the second substrate 8 corresponds to a second substrate side connection point.

[0051]

The placement of the various antennas on the upper surface 8A may be appropriately designed. Each antenna is preferably disposed at a position where the antenna hardly interferes with other antennas. The various antennas are preferably a planar antenna such as a patch antenna and a plate-shaped inverted F antenna. According to the configuration described above, a thickness of the holder case 2 can be reduced.

[0052]

The function provided by the circuit module mounted on the second substrate 8 corresponds to a second function. In other words, according to the present embodiment, each of the GNSS function, the short range communication function, and the wide area communication function corresponds to a second function.

[0053]

<Configuration of Main Case 1, Holder Case 2, and Arm 3>

Next, the configurations of the main case 1, the holder case 2, and the arm 3 will be described. As described above, the main case 1 and the holder case 2 are each formed in a flat rectangular parallelepiped shape. In this example, the main case 1 is made of a resin as an example, but the main case 1 may be made of metal as another mode. In addition, a resin part and a metal part may be combined together. The same applies to the holder case 2 and the arm 3.

[0054]

In the main case 1, an opening portion for exposing the display surface

51 of the display 5 is provided on one of the surfaces (hereinafter, main front surface portion) 11 orthogonal to the thickness direction. In addition, a hole (hereinafter, a draw-out hole) 14 for passing the flexible cable 4 through the hole is provided at a position facing the main side connector 75 on another surface (hereinafter, main back surface portion) 12 opposite to the main front surface portion 11 in the main case 1. The draw-out hole 14 corresponds to a first hole.

[0055]

An arm holding portion 13 for maintaining a state in which one end of the arm 3 and the main case 1 are connected to each other is provided at a portion where the draw-out hole 14 is provided in the main back surface portion 12. For convenience, an end portion of the arm 3 on a side connected to the main case 1 is referred to as a main case side end portion 31.

[0056]

According to the present embodiment, as an example, a connection portion between the arm 3 and the main case 1 has a well-known ball joint structure so that an angle (in other words, an orientation) of the arm 3 with respect to the main case 1 can be changed. In other words, the main case side end portion 31 is formed in a spherical shape (in other words, in a ball shape) and the arm holding portion 13 is configured to cover most of the main case side end portion 31.

[0057]

More specifically, the arm holding portion 13 is realized by combining a ball receiving portion 131 and a cap member 132 together. The ball receiving portion 131 is a member having a portion formed in a recess shape so as to come into contact with a surface of the main case side end portion 31 formed in a spherical shape. A through hole for passing the flexible cable 4 through the through hole is provided in a center portion of the ball receiving portion 131. The ball receiving portion 131 is fixed to the main back surface portion 12 by a screw or the like. Specifically, the ball receiving portion 131 is disposed at a position where the through hole communicates with the draw-out hole 14

provided in the main back surface portion 12.

[0058]

The cap member 132 is a member for covering the main case side end portion 31 abutted against the ball receiving portion 131 from the outside to maintain a state in which the main case side end portion 31 abuts against the ball receiving portion 131. The main case side end portion 31 is sandwiched between the cap member 132 and the ball receiving portion 131, whereby the angle of the arm 3 with respect to the main case 1 is held so as to be adjustable. However, the arm holding portion 13 and the main case side end portion 31 are configured to generate a frictional force to such an extent that the orientation of the main case 1 with respect to the arm 3 does not change due to gravity, vehicle body vibration, or the like. The frictional force generated between the arm holding portion 13 and the main case side end portion 31 can be adjusted by adjusting a force with which the cap member 132 presses the main case side end portion 31.

[0059]

The arm holding portion 13 may be designed so that a movable range of the arm 3 with respect to the main case 1 is about 45 degrees. In the arm 3 according to the present embodiment, when the angle adjustment amount in the arm holding portion 13 is set to 0 degrees, an angle (hereinafter referred to as a pitch angle) θ of the main case 1 with respect to the holder case 2 in a side view is 90 degrees, and an angle (hereinafter referred to as a yaw angle) defined by the left-right direction with respect to the holder case 2 and the left-right direction with respect to the main case 1 in a top view is 0 degrees. FIG. 2 and the like show a state in which the pitch angle θ is adjusted to about 120 degrees while the yaw angle is set to 0 degrees.

[0060]

In the present embodiment, a configuration in which a mechanism (hereinafter referred to as an angle adjustment mechanism) for adjusting the angle of the main case 1 with respect to the holder case 2 is provided at a connection portion between the main case 1 and the arm 3 is described, but the

present disclosure is not limited to the above configuration. The angle adjustment mechanism may be provided at a connection portion between the holder case 2 and the arm 3. As another mode, the angle of the main case 1 with respect to the holder case 2 may not be adjustable. The angle adjustment mechanism may be realized by using a structure other than the ball joint structure.

[0061]

A surface (hereinafter referred to as a holder lower surface portion) 22 of the holder case 2 opposite to the holder upper surface portion 21 is provided with a configuration (hereinafter referred to as arm fitting portion) 23 for connection with a holder case side end portion 32 which is an end portion of the arm 3 opposite to the main case side end portion 31. The connection between the holder case 2 and the arm 3 may be realized by employing, for example, a screw-wound fitting structure or a fitting structure using a hook.

[0062]

As an example, it is assumed that the holder case 2 and the arm 3 are locked by the fitting structure using the hook. For example, the hook may be disposed at the holder case side end portion 32. In that case, the arm fitting portion 23 is provided with a hook receiving portion which engages with a hook provided on the holder case side end portion 32. According to such a configuration, the holder case 2 and the arm 3 can be connected by pushing the holder case side end portion 32 of the arm 3 into the opening portion of the arm fitting portion 23. The draw-out hole 24 through which the flexible cable 4 passes is provided in a portion of the holder lower surface portion 22 where the arm fitting portion 23 is provided. The draw-out hole 24 provided in the holder case 2 corresponds to a second hole.

[0063]

The arm 3 is a cylindrical member having a hollow portion communicating from the main case side end portion 31 to the holder case side end portion 32. The arm 3 may be realized by bending/bending a cylindrical member. The arm 3 is configured such that the pitch angle θ is 90 degrees and

the yaw angle is 0 degrees when the angle adjustment amount in the connection portion with the main case 1 (that is, the arm holding portion 13) is 0 degrees.

[0064]

5 In the present embodiment, as an example, a mode in which the arm 3 is formed in an arcuate shape is adopted, but a shape in which a cylinder is bent once or multiple times may be adopted as described separately as a modification. The arm 3 is disposed such that a line passing through the center of the arm 3 (hereinafter referred to as a center line) is located in the center
10 plane.

[0065]

The flexible cable 4 is a flexible printed circuit board (FPC: Flexible Printed Circuits) formed in a belt-like shape. The flexible printed circuit board also includes a flexible flat cable.

15 [0066]

The flexible cable 4 is longer in length than the arm 3 and is disposed so as to abut on a predetermined region of an inner surface portion of the arm 3. The length of a portion where the flexible cable 4 comes into contact with the inner surface portion of the arm 3 may vary according to the pitch angle θ of the
20 main case 1 with respect to the holder case 2. It is assumed that the length of the flexible cable 4 is set so that the flexible cable 4 abuts on the predetermined region of the inner surface portion of the arm 3 even when the pitch angle θ is an angle at which a distance between the connectors is the greatest.

[0067]

25 However, it is assumed that the flexible cable 4 is set to a length by which the flexible cable 4 does not undulate even when the pitch angle θ is an angle at which the distance between the connectors is the closest. A condition in which the flexible cable 4 undulates refers to a state in which the flexible cable 4 comes in contact with the arm 3 at least two locations, as shown in FIG.

30 5. In other words, a length of the flexible cable 4 is set to a length by which the flexible cable 4 comes in contact with the arm 3 at one point regardless of the

pitch angle θ .

[0068]

A buffer member 9 is attached to a region (hereinafter referred to as an abutment region) of an inner surface portion of the arm 3 against which the flexible cable 4 can abut. FIG. 6 shows a cross-sectional view taken along a line VI-VI in FIG. 2. FIG. 7 is a perspective view conceptually showing an attachment mode of the buffer member 9. As shown in FIGS. 6 and 7, the buffer member 9 is attached to a lower half circumferential portion of the inner surface of the arm 3 so as to include the abutment region.

[0069]

The abutment region itself may be determined by a test or the like. Further, the abutment region may be determined based on a point (hereinafter referred to as an action line intersection point) P_x at which an action line $Ln1$ of a force $F1$ applied to the flexible cable 4 from the first substrate 7 at the time of assembling the main case 1 and the arm 3 and an action line $Ln2$ of a force $F2$ applied to the flexible cable 4 from the second substrate 8 at the time of assembling the holder case 2 and the arm 3 intersect with each other. This is because the flexible cable 4 tends to bend so as to have the action line intersection point P_x as an apex in a state in which the respective members such as the main case 1 are assembled together.

[0070]

For example, as shown in FIG. 8, the abutment region may be a region which falls within a certain distance $D1$ in an extension direction of the arm 3 from a point (hereinafter referred to as an intersection proximity point) closest to the action line intersection point P_x in the inner surface portion of the arm 3. A force $F1$ applied from the first substrate 7 to the flexible cable 4 acts in a direction orthogonal to the first substrate 7, and a force $F2$ applied from the second substrate 8 to the flexible cable 4 acts in a direction orthogonal to the second substrate 8.

[0071]

The buffer member 9 may have any configuration as long as the buffer

member 9 has an effect of relieving an impact at the time of collision between the flexible cable 4 and the arm 3. For example, the buffer member 9 may be realized by being made of an elastically deformable (in other words, soft) material such as a rubber material or a resin material formed in a sponge shape.

5 The buffer member 9 may be attached to the inner surface of the arm 3 with an adhesive, a double-sided tape, or the like.

[0072]

<Effects of Embodiments>

10 In the configuration described above, the flexible cable 4 is disposed so as to abut against the buffer member 9 provided on the inner surface of the arm 3. This makes it possible to reduce the possibility that the flexible cable 4 comes into contact with the inner surface of the arm 3 to generate an unpleasant abnormal sound (for example, a hitting sound) due to a vehicle body vibration caused by the traveling of the vehicle or the like.

15 [0073]

In general, when multiple types of functions are implemented on one information processing terminal, there is no need to place a circuit or the like corresponding to the mounting function on the substrate, so that the substrate size tends to be increased and the housing tends to be increased in size. In particular, when multiple types of wireless communication functions are implemented, the housing tends to be large in size in order to secure isolation between antennas.

[0074]

25 In order to solve the problem described above, according to the present embodiment, electronic components for realizing multiple types of functions can be distributed to the first substrate 7 accommodated in the main case 1 and the second substrate 8 accommodated in the holder case 2. According to the configuration described above, the portable navigation apparatus 100 can be reduced in size. Also, even when the multiple types of wireless communication functions are implemented, the isolation between the antennas is easily ensured. Therefore, the configuration described above is suitable for

30

miniaturization of the portable navigation apparatus 100 having the multiple types of wireless communication functions.

[0075]

5 In other words, the configuration described above can achieve both of the miniaturization of the portable navigation apparatus 100 as the vehicle information terminal and the reduction of the generation of abnormal sounds caused by vehicle body vibration.

[0076]

10 In addition, according to the above-described embodiment, the buffer member 9 is not disposed on the entire inner surface of the arm 3, but is disposed only in a region with which the flexible cable 4 can come into contact (in other words, in a limited manner). According to the configuration described above, the cost resulting from the mounting of the buffer member or the like can be reduced.

15 [0077]

Furthermore, according to the configuration in which the buffer member 9 is provided only in a region with which the flexible cable 4 can come into contact (in other words, in a limited manner), the inner diameter of the arm 3 may be small (that is, even if the arm 3 is thinned) because the buffer member 20 9 occupies a relatively small amount in the internal space of the arm 3. For example, the inner diameter of the arm 3 may be set to about 10 mm to 20 mm. In addition, according to the configuration described above, since the state in which the flexible cable 4 abuts on the buffer member 9 is maintained by the elastic force of the flexible cable 4 itself, there is no need to separately provide 25 a member for maintaining the state in which the buffer member 9 and the flexible cable 4 are in contact with each other. In other words, the above effects can be achieved by a simpler configuration.

[0078]

30 While the embodiments of the present disclosure have been described above, the present disclosure is not limited to the embodiments described above, and various modifications described below are included in the technical

scope of the present disclosure, and may be implemented by various modifications within a scope not departing from the spirit described below.

[0079]

Note that members having the same functions as those described in the above embodiment are denoted by the same reference numerals, and a description of the same members will be omitted. When only a part of the configuration is referred to, the configuration of the embodiment described above can be applied to other parts.

[0080]

[Modification 1]

In the embodiment described above, the arm 3 is formed in a curved shape. However, as shown in FIG. 9, a linear tube may be formed in a one-folded shape. It is needless to say that multiple folding points may be provided. In other words, the arm 3 may be formed in a polygonal line shape.

The buffer member 9 may be disposed in an abutment region determined according to the shape of the arm 3.

[0081]

[Modification 2]

The configuration of the portable navigation apparatus 100 which is intended to be mounted on the front windshield 200 in use has been described above, but the present disclosure is not limited to the above configuration. As shown in FIG. 10, the portable navigation apparatus 100 may be configured to be mounted on an upper surface of a dashboard 400 in use.

[0082]

FIG. 11 is a diagram illustrating an example of a configuration of the portable navigation apparatus 100 that is assumed to be disposed on the dashboard 400 in use. In the portable navigation apparatus 100 which is supposed to be disposed on the dashboard 400 in use, the holder lower surface portion 22 may be attached to the dashboard 400 with a double-sided tape or the like and fixed to the vehicle.

[0083]

[Modification 3]

Although the configuration of the portable navigation apparatus 100 attached to a four-wheeled vehicle has been disclosed above, the portable navigation apparatus 100 may be configured to be attached to a two-wheeled vehicle. The portable navigation apparatus 100 for the two-wheeled vehicle may be attached to a handlebar, for example. The configuration of the portable navigation apparatus 100 is illustrated in FIG. 12, assuming that the portable navigation apparatus 100 is attached to a handlebar portion of the two-wheeled vehicle.

[0084]

The portable navigation apparatus 100 for a two-wheeled vehicle may be realized, for example, by attaching a handlebar attachment portion 500 to the holder lower surface portion 22 of the portable navigation apparatus 100 shown in Modification 2. The handlebar attachment portion 500 may be realized by, for example, a hinge structure. In other words, a movable portion 510 for sandwiching the handlebar of the two-wheeled vehicle is connected to a fixing portion 520 by a hinge portion 530. An end portion 511 of the movable portion 510 opposite to the hinge portion 530 is locked to the fixing portion 520 by a screw 540.

[0085]

The portable navigation apparatus 100 shown in FIG. 12 may be used by being attached to a handlebar of a three-wheeled vehicle. The handlebar attachment portion 500 and the holder lower surface portion 22 may be integrally formed.

[0086]

[Modification 4]

Although the configuration in which three types of antennas, that is, the GNSS antenna 81, the DSRC antenna 83, and the LTE antenna 85, are provided in the portable navigation apparatus 100 has been disclosed above, the portable navigation apparatus 100 does not necessarily have to include all of those antennas. The type of antenna provided in the portable navigation

apparatus 100 may be appropriately designed. For example, the portable navigation apparatus 100 may include only the GNSS antenna 81 and the DSRC antenna 83 as vehicle exterior antennas.

[0087]

5 The portable navigation apparatus 100 may be provided with an antenna of a type other than the types described above. For example, the portable navigation apparatus 100 may include an antenna for receiving a radio broadcast wave, (hereinafter referred to as a radio antenna) as a vehicle exterior antenna. A communication partner for the radio reception antenna is a
10 radio broadcasting station.

[0088]

 The portable navigation apparatus 100 may include an antenna for near-field communication (NFC). The near-field communication in this example refers to communication by a communication method in which a
15 communication distance is sufficiently smaller than a short-range communication distance. For example, the near-field communication refers to a communication in which a communicable distance is about several cm to several tens of cm. In other words, the near-field communication is a communication conforming to a standard such as ISO/IEC 14443 or ISO/IEC
20 18092.

[0089]

 The antenna for the near-field communication may be provided on the first substrate 7 or may be provided on the second substrate 8. Alternatively, the first substrate 7 and the second substrate 8 may be disposed respectively.

25 [0090]

[Modification 5]

 In the above description, the configuration in which the buffer member 9 is disposed only in the region with which the flexible cable 4 is in contact (in other words, in a limited manner) has been disclosed, but the present
30 disclosure is not limited to the above configuration. The buffer member 9 may be disposed on the entire inner surface of the arm 3.

[0091]

[Modification 6]

Although an example in which the vehicle information terminal according to the present disclosure is applied to the portable type navigation apparatus has been disclosed above, the present disclosure is not limited to the
5 above configuration. The vehicle information terminal may be applied to an information processing terminal that does not have a navigation function. The vehicle information terminal can be applied to various information processing terminals such as a car audio device and a drive recorder having a
10 communication function with an external device. In this example, the information processing terminal refers to a communication terminal that displays information based on data received from the outside on a display.

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CLAIMS

1. A vehicle information terminal, comprising:

5 a display (5) that displays information directed to an occupant seated in a driver's seat of a vehicle;

a first housing (1) that accommodates the display and a first substrate (7) on which a circuit providing a predetermined first function is mounted;

10 a second housing (2) that accommodates a second substrate (8) on which a circuit providing a second function is mounted, the second function being different from the first function;

an arm (3) that connects the first housing to the second housing and that supports an orientation of the first housing relative to the second housing; and

15 a cable (4) that connects the first substrate to the second substrate, wherein

the first housing has a first hole (14) through which the cable passes, the second housing has a second hole (24) through which the cable passes,

20 the arm includes a hollow portion which communicates the first hole with the second hole,

the cable is disposed to pass through the hollow portion as an inner space of the arm and to abut against a predetermined abutment region of an inner surface portion of the arm, and

25 a buffer member (9) which is elastically deformable is attached to the abutment region.

2. The vehicle information terminal according to claim 1, wherein the buffer member is not disposed in a portion other than the abutment region in the inner surface portion of the arm.

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3. The vehicle information terminal according to claim 1 or 2, wherein

the first substrate includes a first substrate side connection point to which the cable is connected at a position opposite to the first hole,

the second substrate includes a second substrate side connection point to which the cable is connected at a position opposite to the second hole,

5 the first hole, the second substrate side connection point, and the second hole are all disposed in a central plane which is a plane passing through the first substrate side connection point and orthogonal to a left-right direction of the display,

10 the arm is formed in an arcuate shape or a polygonal line shape to communicate the first hole with the second hole, and

15 the abutment region is configured to, in the inner surface portion of the arm, include an intersection proximity point which is a point closest to an intersection point between a straight line (Ln1) passing through the first substrate side connection point and being perpendicular to the first substrate, and a straight line (Ln2) passing through the second substrate side connection point and being perpendicular to the second substrate.