

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. 2017-7635 filed on January 19, 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.

15

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 includes, 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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30 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, a circuit to be mounted on the circuit board increases, so that the circuit board increases in size, resulting in an increase in size of the main case. On the other hand, 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 of the main case with respect to the holder case. A communication cable connecting the two circuit boards is accommodated in the cylindrical arm. With the employment of a configuration in which the communication cable is passed through the arm, the communication cable can be protected and an appearance can be made clear.

[0008]

However, in the supposed configuration as described above, there are two portions of one portion where the main case and the arm are connected to each other and the other portion where the holder case and the arm are connected to each other. In order to protect the respective circuit boards from liquid (for example, rain) falling from above the vehicle information terminal, it is preferable to provide a waterproof structure using an O-ring (in other words,

a packing) at each of the connection portion between the main case and the arm and the connection portion between the holder case and the arm. However, if the waterproof structure is introduced at each of the two connection portions, there is a possibility that the cost of parts increases and an assembling operation becomes complicated.

[0009]

The present disclosure has been made based on the above circumstances, and an object of the present disclosure is to provide a vehicle information terminal capable of compatibly downsizing a main case and reducing a manufacturing cost.

[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 substrate on which a circuit providing a predetermined first function is mounted, a second substrate on which a circuit providing a second function different from the first function is mounted, a cable that connects the first substrate to the second substrate, a surface of the cable being covered with a protective film made of a resin, a first housing that accommodates the display and the first substrate, a back surface portion of the first housing having a first hole through which the cable passes, a second housing that accommodates the second substrate and that includes a second hole through which the cable passes, and an arm that is formed of a cylindrical member which supports an orientation of the first housing with respect to the second housing, the arm having a hollow portion for communicating the first hole with the second hole, where the cable passes through the first hole and the second hole and is disposed inside the arm, the second housing has a second housing downward surface that faces downward from a horizontal plane in a regular orientation, the regular orientation being defined as a correct mounting orientation corresponding to a direction in which a display screen of the display faces, the second hole is provided in the second housing downward

surface, a sealing portion that seals a gap between the first hole and the cable is integrally formed with the protective film in a portion of the protective film passing through the first hole, while a configuration for sealing a gap between the second hole and the cable is not provided in a portion of the protective film passing through the second hole, and a pressing portion that brings the sealing portion into close contact with the first housing is provided in a connection portion between the first housing and the arm.

[0011]

In the configuration described above, the sealing portion integrally formed with the flexible cable is brought into close contact with the first housing by the pressing portion. In other words, according to the above configuration, the first hole provided in the first housing is sealed by the sealing portion so that the liquid such as water can be inhibited from entering into the first housing from the first hole.

[0012]

In the configuration described above, the second housing downward surface is a surface designed to face downward from the horizontal plane when the vehicle information terminal is attached to the vehicle in the regular orientation. Since the second hole is provided on the second housing downward surface, the opening direction of the second hole is downward from the horizontal plane. Therefore, even if liquid (for example, rain) falls on the vehicle information terminal from above, there is a low possibility that the liquid enters the second housing from the second hole. For that reason, even if a waterproof structure is not provided at the connection portion between the second housing and the arm, the waterproof property of the second housing can be ensured by the above configuration.

[0013]

In other words, according to the configuration described above, the waterproof property against the liquid falling from above can be ensured without providing the waterproof structure at both the connection portion

between the first housing and the arm and the connection portion between the second housing and the arm. Therefore, as compared to the configuration in which the waterproof structure is provided at both of the connection portion between the first housing and the arm and the connection portion between the second housing and the arm, the manufacturing cost can be reduced.

[0014]

Further, in the configuration described above, the function to be provided in the vehicle information terminal can be implemented with the use of not only the first substrate accommodated in the first housing but also the second substrate accommodated in the second housing. 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. In other words, according to the above configuration, both of the reduction in size of the main case and the reduction of the manufacturing cost can be achieved.

[0015]

Further, 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 substrate on which a circuit providing a predetermined first function is mounted, a second substrate on which a circuit providing a second function different from the first function is mounted, a cable that connects the first substrate to the second substrate, a surface of the cable being covered with a protective film made of a resin, a first housing that accommodates the display and the first substrate, the first housing including a first hole through which the cable passes, a second housing that accommodates the second substrate, the second housing including a second hole through which the cable passes, and an arm that is formed of a cylindrical member which supports an orientation of the first housing with respect to the second housing, the arm being configured to communicate the first hole with the second hole, where the cable passes through the first hole and the second

hole and is disposed inside the arm, the first housing has a first housing downward surface that faces downward from a horizontal plane in a regular orientation, the regular orientation being defined as a correct mounting orientation corresponding to a direction in which a display screen of the display faces, the first hole is provided in the first housing downward surface, the first hole is provided in the first housing such that an opening of the first hole faces downward from the horizontal plane, a sealing portion that seals a gap between the second hole and the cable is integrally formed in a portion of the protective film passing through the second hole, while a configuration for sealing a gap between the first hole and the cable is not provided in a portion of the protective film passing through the first hole, and a pressing portion that brings the sealing portion into close contact with the second housing is provided in a connection portion between the second housing and the arm.

[0016]

In the configuration described above, the sealing portion integrally formed with the flexible cable is brought into close contact with the second housing by the pressing portion. In other words, according to the above configuration, the second hole provided in the second housing is sealed by the sealing portion so that the liquid such as water can be inhibited from entering into the second housing from the second hole.

[0017]

In the configuration described above, the first housing downward surface is a surface designed to face downward from the horizontal plane when the vehicle information terminal is attached to the vehicle in the regular orientation. Since the first hole is provided on the first housing downward surface, the opening direction of the first hole is downward from the horizontal plane. Therefore, even if liquid (for example, rain) falls on the vehicle information terminal from above, there is a low possibility that the liquid enters the first housing from the first hole. For that reason, even if a waterproof structure is not provided at the connection portion between the first housing

and the arm, the waterproof property of the first housing can be ensured by the above configuration.

[0018]

That is, even in the above-described configuration, waterproofness
5 against the liquid falling from above can be ensured without providing a waterproof structure at both the connection portion between the first housing and the arm and the connection portion between the second housing and the arm. Therefore, as compared to the configuration in which the waterproof structure is provided at both of the connection portion between the first
10 housing and the arm and the connection portion between the second housing and the arm, the manufacturing cost can be reduced.

[0019]

Further, in the configuration described above, the function to be provided in the vehicle information terminal can be implemented with the use of
15 not only the first substrate accommodated in the first housing but also the second substrate accommodated in the second housing. In other words, even according to the above configuration, both of the reduction in size of the main case and the reduction of the manufacturing cost can be achieved.

20 BRIEF DESCRIPTION OF DRAWINGS

[0020]

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

25 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.

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.

30 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.

5 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 an example of mounting the portable navigation apparatus 100 to the vehicle.

10 FIG. 10 is a diagram showing a schematic configuration of the portable navigation apparatus 100 mounted on a dashboard 400 in use.

FIG. 11 is a diagram showing a configuration of the portable navigation apparatus 100 mounted on a bar type handlebar in use.

15 DESCRIPTION OF EMBODIMENTS

[0021]

[First Embodiment]

Hereinafter, a portable navigation apparatus 100 to which the present disclosure is applied will be described with reference to the drawings as an
20 example of a first 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.

25 [0022]

<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
30 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.

[0023]

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. As an example, it is assumed that the portable navigation apparatus 100 performs a wide area communication in accordance with an LTE (Long Term Evolution) standard.

[0024]

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.

[0025]

5 It should be noted that the roadside device is installed above the road (for example, at a position where the height from the road surface is equal to or greater than the 5 m) so as to distribute the information to limited areas on the road. 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.

[0026]

<Configuration of Portable Navigation Apparatus 100>

20 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 supports the orientation of the main case 1 with respect to the holder case 2. 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 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.

[0027]

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
5 case 2 accommodates a second substrate 8, which is a printed circuit board on which various electronic components are mounted. The first substrate 7 and the second substrate 8 are mutually communicably connected to each other by a flexible cable 4 passed through the arm 3.

[0028]

10 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 face a driver's seat. Therefore, in the portable navigation apparatus 100, the vertical direction and the left-right direction are set so as to correspond to a direction in which the display screen of the display 5 faces.

15 [0029]

The portable navigation apparatus 100 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
20 that the up-down direction coincides with the height direction of the vehicle. The left-right direction and the up-down direction for the main case 1 are determined in accordance with a display facing direction of the display 5, similarly to the up-down direction and the left-right direction for the portable navigation apparatus 100. A state indicated by the coincidence in the present
25 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.

30 [0030]

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.

[0031]

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 first 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.

[0032]

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. A thickness direction substantially coincides with the depth direction described above. 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.

[0033]

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 various electronic components are mounted.

[0034]

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 correct orientation (hereinafter referred to as a regular orientation). Reference numeral 22 denotes a surface of the holder case 2 on the opposite side of the holder upper surface portion 21 (hereinafter referred to as a holder lower surface portion). The holder lower surface portion 22 corresponds to a second housing downward surface.

[0035]

The regular orientation in this example is an attachment orientation assumed at the time of designing the portable navigation apparatus 100. The regular orientation is an orientation in which the display facing direction of the display 5 (that is, the up-down direction and the left-right direction) 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, the holder case 2, and the arm 3 will be described later.

[0036]

<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 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.

5 [0037]

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,
10 to display an image.

[0038]

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
15 touched by the user and, if touched, a touch position (hereinafter, referred to as a touch position signal) to a touch panel controller 72.

[0039]

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
20 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
25 input devices.

[0040]

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. The circuit mounted on the first substrate
30 7 may be appropriately designed to provide a desired function. Circuits

providing the desired functions may be implemented with the use of various electronic components. 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.

[0041]

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.

[0042]

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.

[0043]

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.

[0044]

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.

[0045]

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).

[0046]

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.

[0047]

The main side connector 75 is disposed at a position facing a main side wiring hole 14, which will be described later, in the first substrate 7. 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.
[0048]

The function provided by the circuit mounted on the first substrate 7 corresponds to a first function. Specifically, each of 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 corresponds to a first function.

[0049]

<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.

[0050]

The circuit mounted on the second substrate 8 may be appropriately designed to provide a predetermined second function. 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.

[0051]

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.

[0052]

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.

[0053]

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.

[0054]

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.

[0055]

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 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.

[0056]

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.

[0057]

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 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 lower surface 8B.

[0058]

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

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 positioned in the lower surface 8B opposite the holder side wiring hole 23 formed in the lower surface portion 22 of the holder.

5 [0059]

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.

[0060]

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 first embodiment, each of the GNSS function, the short range communication function, and the wide area communication function corresponds to a second function.

[0061]

<Configuration of Main Case 1, etc.>

20 Next, the configurations of the main case 1, the holder case 2, the arm 3, and the flexible cable 4 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.

25 [0062]

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 circular

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hole (hereinafter referred to as a main side wiring hole) 14 through which the flexible cable 4 passes is provided at a position facing the main side connector 75 on a surface (hereinafter referred to as a main back surface portion) 12 on the opposite side of the main front surface portion 11 in the main case 1. The
5 main side wiring hole 14 corresponds to a first hole. A shape of the main side wiring hole 14 is a design matter and is not limited to the circular shape. The shape of the main side wiring hole 14 may be a square, a hexagon, or the like.
[0063]

A pedestal portion 121 to which the arm holding portion 13 is attached
10 is provided in the periphery of the main side wiring hole 14 in the main back surface portion 12. The arm holding portion 13 is configured to maintain a state in which one end of the arm 3 and the main case 1 are connected to each other. The pedestal portion 121 includes an annular recess portion 122 provided so as to surround the main side wiring hole 14. A sealing portion 44, which will be
15 described later, provided in the flexible cable 4 is accommodated in the recess portion 122. For convenience, an end of the arm 3 on the side connected to the main case 1 is referred to as a main case side end portion 31.

[0064]

According to the first embodiment, as an example, a connection portion
20 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 main case 1 with respect to the arm 3 can be changed. 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 the spherical main case side end portion 31.

25 [0065]

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 recess portion for abutting against the surface of the main case side end portion 31. A through hole for passing the flexible cable 4 through
30 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 attached at a position where the through hole communicates with the main side wiring hole 14 provided in the main back surface portion 12.

5 [0066]

The cap member 132 covers the main case side end portion 31 abutted against the ball receiving portion 131 from the outside, thereby maintaining 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.

[0067]

20 The arm holding portion 13 described above 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 in the first embodiment, when the angle adjustment amount in the arm holding portion 13 is 0 degree, the angle (hereinafter, pitch angle) θ of the main case 1 with respect to the holder case 2 in the side view is 90 degrees, and the angle (hereinafter, yaw angle) formed 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 the top view is 0 degree. 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.

30 [0068]

In the present first 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.

[0069]

The holder lower surface portion 22 is provided with a circular holder side wiring hole 23 through which the flexible cable 4 passes. The holder side wiring hole 23 provided in the holder case 2 corresponds to a second hole. A shape of the holder side wiring hole 23 is a design matter, and may be a shape other than the circular shape.

[0070]

The holder side wiring hole 23 is provided so as to be positioned in a plane orthogonal to the left-right direction of the main case 1 through the main side wiring hole 14 in a state in which the angle adjustment amount of the main case 1 is set to 0 degrees. Therefore, when the angle adjustment amount of the main case 1 is set to 0 degrees, the main side connector 75, the holder side connector 87, the holder side wiring hole 23, the main side wiring hole 14, and the main side connector 75 are all positioned in the same plane parallel to the second substrate orthogonal direction.

[0071]

The holder side wiring hole 23 is disposed in the holder lower surface portion 22. For that reason, the opening direction of the holder side wiring hole 23 faces downward from the horizontal plane. The opening direction of the holder side wiring hole 23 in this example is a direction from the inside of the

housing to the outside in a direction orthogonal to a radial direction of the holder side wiring hole 23.

[0072]

A configuration (hereinafter referred to as an arm fitting portion) 24 for
5 connecting to the arm 3 is provided in the periphery of the holder side wiring
hole 23. The arm fitting portion 24 is provided upright on the holder lower
surface portion 22 in a cylindrical shape having a diameter for accommodating
the holder case side end portion 32 so as to surround the holder side wiring
hole 23. For convenience, one of the end portions of the arm 3, which is
10 connected to the holder case 2, is referred to as a holder case side end portion
32. The holder case side end portion 32 is an end portion of the arm 3 opposite
to the main case side end portion 31.

[0073]

The connection between the holder case 2 and the arm 3 may be
15 realized by employing, for example, a screw-wound fitting structure or a fitting
structure using a hook. As an example, it is assumed that the holder case 2 and
the arm 3 are locked by the fitting structure using the hook. The hook is
provided at the holder case side end portion 32. The arm fitting portion 24 is
provided with a hook receiving portion which engages with a hook provided on
20 the holder case side end portion 32. According to the configuration described
above, the holder case 2 and the arm 3 can be connected to each other by
engaging the hook provided on the holder case side end portion 32 and the
hook receiving portion provided on the arm fitting portion 24.

[0074]

25 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
30 connection portion with the main case 1 (that is, the arm holding portion 13) is

0 degrees. In the first 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.

[0075]

5 The flexible cable 4 is a flexible printed circuit board (FPC: Flexible Printed Circuits) formed by patterning printed conductor circuits on a base film made of a material having an insulating property and a flexibility such as polyimide. The flexible cable 4 is generally formed in a belt shape. The flexible printed circuit board includes a so-called flexible flat cable. A printed conductor
10 circuit formed on the base film functions as a signal line. For convenience, the base film and the printed conductor circuit formed on the base film are collectively referred to as a core wire portion 40.

[0076]

15 As shown in FIGS. 5 and 6, one end of the flexible cable 4 (specifically, the core wire portion 40) is formed as a main side terminal portion 41 connected to the main side connector 75. The other end is formed as a holder side terminal portion 42 connected to the holder side connector 87. In the flexible cable 4, the core wire portion 40 other than the main side terminal portion 41 and the holder side terminal portion 42 is covered with a protective
20 film 43 made of a flexible resin.

[0077]

25 A sealing portion 44 for closing a gap between the main side wiring hole 14 and the flexible cable 4 is integrally formed at a position passing through the main side wiring hole 14 in the protective film 43. In the protective film 43, a structure corresponding to a sealing portion is not formed at a position passing through the holder side wiring hole 23. FIG. 7 is a cross-sectional view showing a structure of the sealing portion 44.

[0078]

30 As shown in FIG. 7, the sealing portion 44 extends in a direction orthogonal to the flexible cable 4. The sealing portion 44 is formed so that a

cross-sectional shape in a plane orthogonal to the core wire portion 40 has a circular shape centered on the core wire portion 40. In the first embodiment, as an example, a protrusion portion 441 having a circular cross-sectional shape in the plane orthogonal to the core wire portion 40 is further provided in the periphery of the core portion 40. A radius of the protrusion portion 441 is set to be equal to a radius of the main side wiring hole 14 or slightly smaller than the radius of the main side wiring hole 14. The protrusion portion 441 has a function of reducing a positional deviation of the flexible cable 4 with respect to the main side wiring hole 14.

[0079]

As shown in FIG. 8, an outer edge portion 442, which is a portion outside the protrusion portion 441 in the sealing portion 44, is fitted into the recess portion 122 provided in the main back surface portion 12. By attaching the ball receiving portion 131 to the pedestal portion 121 of the main back surface portion 12 in a state in which the outer edge portion 442 is fitted into the recess portion 122, the outer edge portion 442 is sandwiched between the ball receiving portion 131 and the recess portion 122 and fills (in other words, infills) a gap of the main side wiring hole 14. In other words, the outer edge portion 442 functions as a gasket.

[0080]

Reference numeral 133 in FIG. 8 denotes a portion facing the recess portion 122, in other words, a portion abutting against the sealing portion 44 (hereinafter, a pressing portion) in the surfaces of the ball receiving portion 131, which face the main back surface portion 12. The pressing portion 133 has a function of bring the sealing portion 44 into close contact with the main case 1 (more specifically, the recess portion 122).

[0081]

In order to achieve the above effects, a thickness T of the outer edge portion 442 is set to a value equal to a depth of the recess portion 122 or larger than the depth of the recess portion 122 in a range in which a gap does not

occur between the ball receiving portion 131 and the pedestal portion 121. When the thickness T of the outer edge portion 442 is larger than the depth of the recess portion 122, the outer edge portion 442 is elastically deformed by a pressure applied by the ball receiving portion 131, and the gap between the members can be more strongly closed.

[0082]

Further, in the first embodiment, as an example, the pressing portion 133 is formed in a plane shape continuous with a surface of the ball receiving portion 131 which abuts against the pedestal portion 121 (hereinafter referred to as a pedestal abutment surface), but the shape of the pressing portion 133 is not limited to the above example. The pressing portion 133 may be formed in a convex shape with respect to the pedestal abutment surface.

[0083]

<Effects of First Embodiment>

In the configuration described above, the connection portion between the arm 3 and the main back surface portion 12 is sealed with the sealing portion 44 integrally formed with the flexible cable 4. With the provision of the above waterproof structure using the sealing portion 44 at the connection portion between the main case 1 and the arm 3, the liquid such as water can be inhibited from entering the main case 1 from the main side wiring hole 14.

[0084]

Further, in the configuration described above, the holder lower surface portion 22 is a surface designed so as to face downward from the horizontal plane when the holder lower surface portion 22 is mounted on the vehicle in the regular orientation. Since the holder side wiring hole 23 is provided in the holder lower surface portion 22, the opening direction of the holder side wiring hole 23 faces downward from the horizontal plane. Therefore, even if a liquid (for example, rain) falls from above the portable navigation apparatus 100, there is a low possibility that the liquid will enter the holder case 2. In other words, even if the waterproof structure is not provided at the connection

portion between the holder case 2 and the arm 3, the waterproof property of the holder case 2 can be ensured by the configuration described above. For that reason, as in the first embodiment described above, the introduction of the waterproof structure at the connection portion between the arm 3 and the holder lower surface portion 22 can be omitted.

[0085]

In other words, according to the configuration described above, the waterproof property against the liquid falling from above can be ensured without providing the waterproof structure at both the connection portion between the main case 1 and the arm 3 and the connection portion between the holder case 2 and the arm 3. Therefore, as compared to the configuration in which the waterproof structure is provided at both of the connection portion between the main case 1 and the arm 3 and the connection portion between the holder case 2 and the arm 3, the manufacturing cost can be reduced.

[0086]

In addition, if a sealing member independent of the flexible cable such as an O-ring is used for waterproofing, a work step of attaching the seal member to the housing occurs separately from the work of attaching the flexible cable. On the other hand, according to the first embodiment, since the sealing portion 44 functioning as a gasket is integrally formed with the protective film 42 of the flexible cable 4, the sealing member is attached when the flexible cable 4 is attached. In other words, one work step can be omitted as compared with the above-described assumed configuration. As a result, the manufacturing cost can be further reduced. In addition, the assembling operation can be simplified.

[0087]

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.

[0088]

5 In order to solve the problem described above, according to the first 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 main case 1 can be reduced in size. Also,
10 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 miniaturization of the portable navigation apparatus 100 having the multiple types of wireless communication functions. In other words, according to the configuration described above, both
15 of the reduction in size of the portable navigation apparatus 100 as the vehicle information terminal and the reduction of the manufacturing cost can be achieved.

[0089]

20 While the first embodiment of the present disclosure has been described above, the present disclosure is not limited to the first embodiment 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. Note that members having the same functions as those described in the first
25 embodiment described above 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 first embodiment described above can be applied to other parts.

[0090]

30 [Second Embodiment]

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. 9, the portable navigation apparatus 100 may be configured to be mounted on an upper surface of a dashboard 400 in use. Such a configuration will be described below as a second embodiment.

[0091]

FIG. 10 is a diagram illustrating an example of a configuration of a portable navigation apparatus 100 that is assumed to be disposed on a dashboard 400 in use. Since the portable navigation apparatus 100 according to the second embodiment is mounted on the dashboard 400, the portable navigation apparatus 100 is located at a position lower than a position of the driver's eye. Therefore, in the portable navigation apparatus 100 according to the second embodiment, a state in which a main case 1 is inclined by a predetermined angle relative to a vertical direction is defined as a regular orientation of the portable navigation apparatus 100 so that a display surface 51 faces a center of an eyellipse. The eyellipses are set in advance based on an eye range statistically representing distributions of eye points of an occupant (that is, a driver) in a driver's seat (refer to JISD0021: 1998 in detail).

[0092]

In the portable navigation apparatus 100 according to the second embodiment, 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. The holder side wiring hole 23 according to the second embodiment is formed in the holder upper surface portion 21, and the arm 3 is attached to each case so that the main side wiring hole 14 provided in the main back surface portion 12 and the holder side wiring hole 23 provided in the holder upper surface portion 21 communicate with each other.

[0093]

In the regular orientation, the main back surface portion 12 faces

downward from the vehicle horizontal plane. For that reason, the opening direction of the main side wiring hole 14 also faces downward from the horizontal plane of the vehicle. The opening direction of the main side wiring hole 14 is a direction from the inside to the outside of the housing in a direction orthogonal to the radial direction of the main side wiring hole 14. In the second embodiment, the main back surface portion 12 corresponds to a first housing downward surface.

[0094]

According to the configuration described above, even if the liquid falls from above the portable navigation apparatus 100, there is a low possibility that the liquid enters the main case 1. Therefore, according to the second embodiment, a structure corresponding to the sealing portion 44 is not formed in the flexible cable 4 at a position passing through the main side wiring hole 14. According to the present embodiment, as a more preferable configuration, it is assumed that an umbrella 123 is provided upright with respect to the main back surface portion 12 at an edge of the main side wiring hole 14, in particular, at an edge portion positioned on the upper side in the regular orientation. With the provision of the umbrella 123 in the periphery of the wiring hole 14, the possibility that the liquid falling from above the portable navigation apparatus 100 enters the main case 1 from the main side wiring hole 14 can be reduced.

[0095]

On the other hand, in the normal orientation, the holder upper surface portion 21 is a surface facing upward. Therefore, when the portable navigation apparatus 100 is mounted in the regular orientation, the opening direction of the holder side wiring hole 23 also faces upward. In the configuration described above, if the holder side wiring hole 23 is not provided with a waterproof structure, there is a possibility that the liquid falling from above the portable navigation apparatus 100 enters the holder case 2. Therefore, according to the second embodiment, the sealing portion 44 is formed in the flexible cable 4 at a position passing through the holder side wiring hole 23. In other words, the

second embodiment differs from the first embodiment in the position where the sealing portion 44 is provided in the flexible cable 4. The structure itself of the sealing portion 44 may be the structure described in the first embodiment.

[0096]

5 When the main side terminal portion 41 and the holder side terminal portion 42 are formed in the same shape, the flexible cable 4 is substantially not facing any direction. Therefore, when the main side terminal portion 41 and the holder side terminal portion 42 are formed in the same shape, the flexible cable 4 described in the first embodiment can be used as the flexible cable 4 in the
10 second embodiment.

[0097]

 Further, in the holder upper surface portion 21 according to the second embodiment, an arm pedestal portion 25 to which the holder case side end portion 32 of the arm 3 is fixed is provided in the vicinity of the holder side
15 wiring hole 23 instead of the arm fitting portion 24. The arm pedestal portion 25 includes an annular sealing portion recess portion 26 formed so as to surround the holder side wiring hole 23. The sealing portion recess portion 26 accommodates the sealing portion 44 of the flexible cable 4.

[0098]

20 An annular case attachment portion 321 extending in the radial direction is formed in the holder case side end portion 32 of the second embodiment. The case attachment portion 321 is in contact with the arm pedestal portion 25 using a screw or the like. Reference numeral 322 shown in FIG. 10 denotes a portion (i.e., a pressing portion) of the case attachment
25 portion 321, which brings the sealing portion 44 into close contact with the holder case 2 (more specifically, the sealing portion recess portion 26). The pressing portion 322 according to the second embodiment corresponds to a portion of the case attachment portion 321 which faces the sealing portion recess portion 26, in other words, a portion that abuts against the sealing
30 portion 44.

[0099]

The case attachment portion 321 and the arm pedestal portion 25 are provided with holes through which screws pass. A tightening strength of the screws is adjusted so that a pressure applied by the pressing portion 322 to the sealing portion 44 can be adjusted. The configuration described above also achieves the same effects as those of the first embodiment described above.

[0100]

[Modification 1]

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. 11, assuming that the portable navigation apparatus 100 is attached to a handlebar portion of the two-wheeled vehicle.

[0101]

The portable navigation apparatus 100 for the 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 1. 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.

[0102]

The portable navigation apparatus 100 shown in FIG. 11 may be used by being attached to the handlebar of a three-wheeled vehicle. The handlebar attachment portion 500 and the holder lower surface portion 22 may be

integrally formed.

[0103]

[Modification 2]

Although the configuration in which three types of antennas, that is, the
5 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
10 navigation apparatus 100 may include only the GNSS antenna 81 and the DSRC
antenna 83 as vehicle exterior antennas.

[0104]

The portable navigation apparatus 100 may be provided with an
antenna of a type other than the types described above. For example, the
15 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
radio broadcasting station.

[0105]

20 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
communication distance is sufficiently smaller than a short-range
communication distance. For example, the near-field communication refers to a
25 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
18092.

[0106]

30 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.
[0107]

[Modification 3]

5 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 above configuration. The vehicle information terminal may be applied to an information processing terminal that does not have a navigation function. The
10 vehicle information terminal can be applied to various information processing terminals such as a car audio device and a drive recorder having a 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.

15

CLAIMS

1. A vehicle information terminal, comprising:

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

a first substrate (7) on which a circuit providing a predetermined first
function is mounted;

a second substrate (8) on which a circuit providing a second function
different from the first function is mounted;

10 a cable (4) that connects the first substrate to the second substrate, a
surface of the cable being covered with a protective film made of a resin;

a first housing (1) that accommodates the display and the first substrate,
a back surface portion of the first housing having a first hole (14) through which
the cable passes;

15 a second housing (2) that accommodates the second substrate and that
includes a second hole (23) through which the cable passes; and

an arm (3) that is formed of a cylindrical member which supports an
orientation of the first housing with respect to the second housing, the arm
having a hollow portion for communicating the first hole with the second hole,
20 wherein

the cable passes through the first hole and the second hole and is
disposed inside the arm,

the second housing has a second housing downward surface that faces
downward from a horizontal plane in a regular orientation, the regular
25 orientation being defined as a correct mounting orientation corresponding to a
direction in which a display screen of the display faces,

the second hole is provided in the second housing downward surface,

a sealing portion (44) that seals a gap between the first hole and the
cable is integrally formed with the protective film in a portion of the protective
30 film passing through the first hole, while a configuration for sealing a gap

between the second hole and the cable is not provided in a portion of the protective film passing through the second hole, and

a pressing portion (133) that brings the sealing portion into close contact with the first housing is provided in a connection portion between the first housing and the arm.

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

the sealing portion includes an annular outer edge portion (442) extending in a direction orthogonal to the cable,

a recess portion (122) that accommodates the outer edge is provided around the first hole of the first housing, and

the outer edge is sandwiched between the pressing portion and the recess portion.

3. A vehicle information terminal, comprising:

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

a first substrate (7) on which a circuit providing a predetermined first function is mounted;

a second substrate (8) on which a circuit providing a second function different from the first function is mounted;

a cable (4) that connects the first substrate to the second substrate, a surface of the cable being covered with a protective film made of a resin;

a first housing (1) that accommodates the display and the first substrate, the first housing including a first hole (14) through which the cable passes;

a second housing (2) that accommodates the second substrate, the second housing including a second hole (23) through which the cable passes; and

an arm (3) that is formed of a cylindrical member which supports an orientation of the first housing with respect to the second housing, the arm

being configured to communicate the first hole with the second hole, wherein
the cable passes through the first hole and the second hole and is
disposed inside the arm,

the first housing has a first housing downward surface that faces
downward from a horizontal plane in a regular orientation, the regular
orientation being defined as a correct mounting orientation corresponding to a
direction in which a display screen of the display faces,

the first hole is provided in the first housing downward surface,

the first hole is provided in the first housing such that an opening of the
first hole faces downward from the horizontal plane,

a sealing portion (44) that seals a gap between the second hole and the
cable is integrally formed in a portion of the protective film passing through the
second hole, while a configuration for sealing a gap between the first hole and
the cable is not provided in a portion of the protective film passing through the
first hole, and

a pressing portion (322) that brings the sealing portion into close
contact with the second housing is provided in a connection portion between
the second housing and the arm.

4. The vehicle information terminal according to claim 3, wherein

the sealing portion includes an annular outer edge portion (42)
extending in a direction orthogonal to the cable,

a sealing portion recess portion (26) that accommodates the outer edge
is provided around the second hole of the second housing, and

the outer edge is sandwiched between the pressing portion and the
sealing portion recess portion.