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(54) **PORTABLE COMMUNICATION TERMINAL**

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(57) **ABSTRACT**

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In the upper enclosure, a CPU for application and a memory for application as well as an application device are mounted. In the lower enclosure, a CPU for communication as well as a transmission/reception circuit are mounted. In such a configuration, the data transfer for application processing is executed mainly in the upper enclosure. Thus, the quantity of data passing through the folding portion from/to the lower enclosure for the application processing is reduced. The wire harness is simplified and power consumption is reduced.

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**Related U.S. Application Data**

(63) Continuation of application No. 10/954,234, filed on Oct. 1, 2004, now Pat. No. 7,430,443.

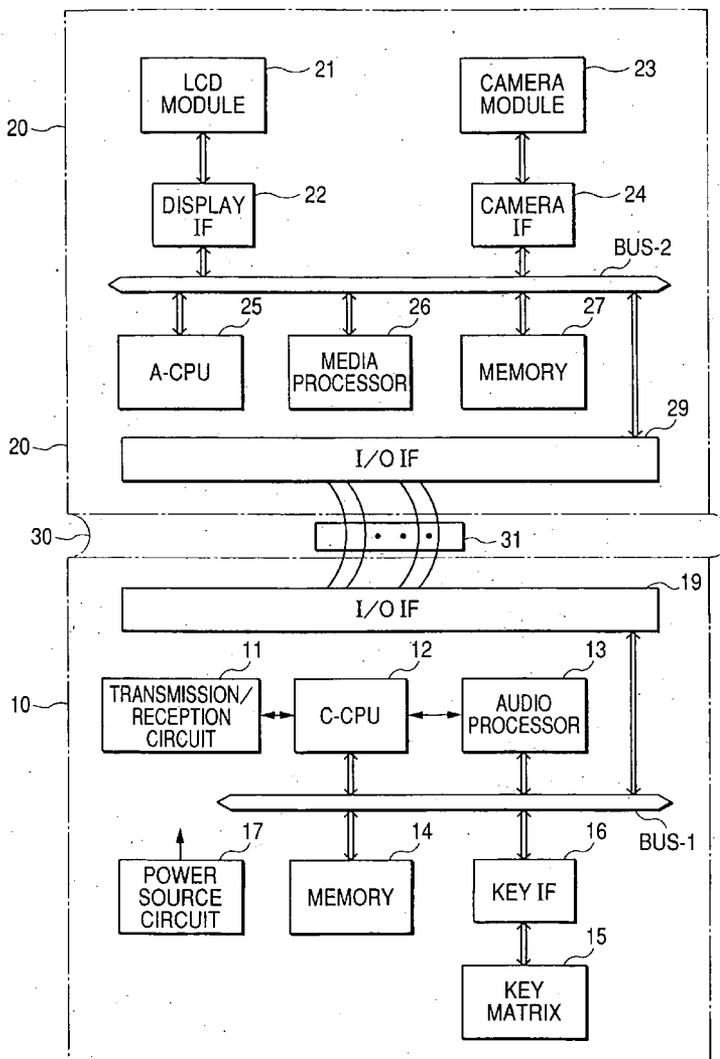


FIG. 1

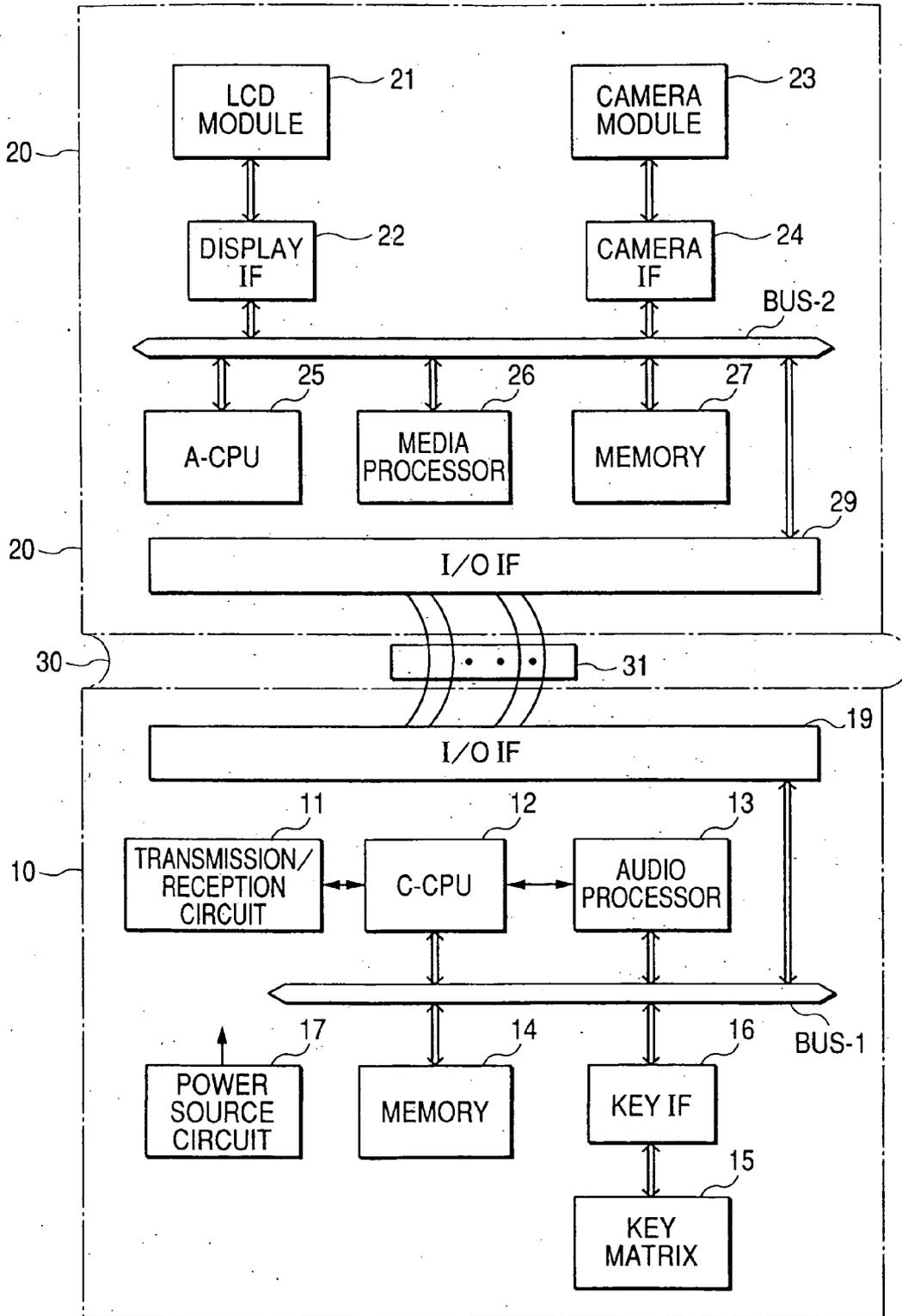


FIG. 2A

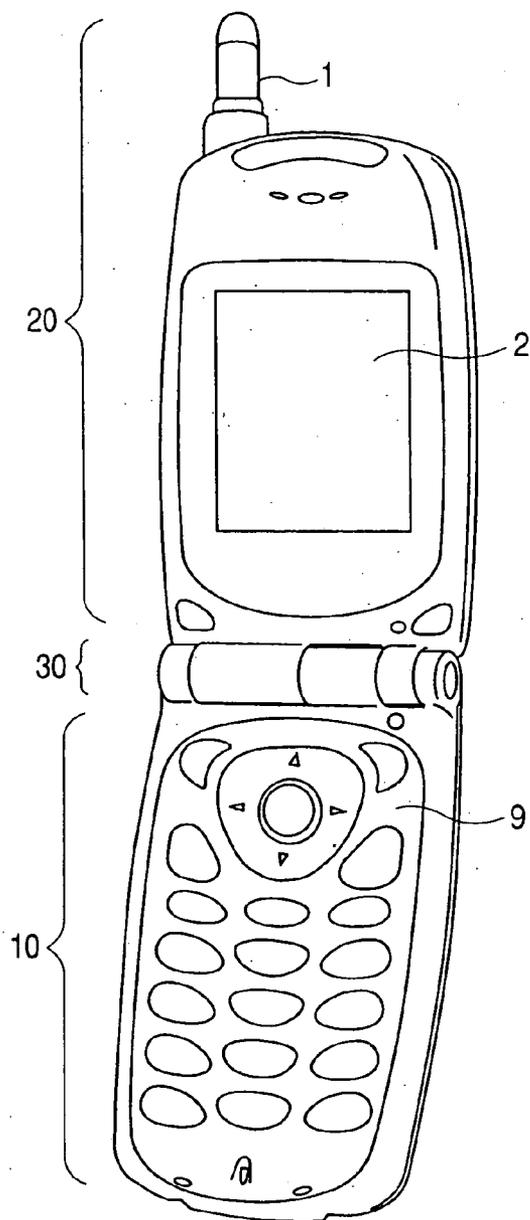
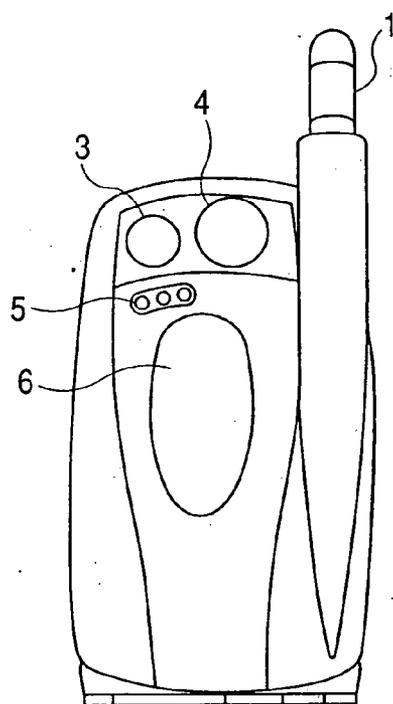


FIG. 2B



## PORTABLE COMMUNICATION TERMINAL

**[0001]** This application claims foreign priority based on Japanese patent application JP 2003-343989, filed on Oct. 2, 2003, the contents of which is incorporated herein by reference in its entirety.

### BACKGROUND OF THE INVENTION

**[0002]** 1. Field of the Invention

**[0003]** The present invention relates to a portable communication terminal such as a foldable cellular phone having a function device (application device) such as a display unit and capable of implementing various functions.

**[0004]** 2. Description of the Related Art

**[0005]** FIGS. 2A and 2B are views showing the appearance of a foldable cellular phone. FIG. 2A shows an opened state; and FIG. 2B shows a folded state. The cellular phone includes an upper enclosure **20** in which an LCD (liquid crystal display) panel, a camera, etc. are mounted, a lower enclosure **10** in which a transmission/reception circuit, a CPU, etc. are mounted, and a folding portion **30** for foldably coupling these enclosures.

**[0006]** The upper enclosure **20** includes, on its inner side, a main LCD panel **2** which can be seen when opened. The upper enclosure **20** also includes, on its outer side, an antenna **1**, a high sensitivity mobile camera **3**, a positioning mirror **4** serving as a standard of a display range of an image, an LED (light emitting diode) **5**, a subsidiary LCD panel **6**. The LED **5** displays e.g. calling information. The subsidiary LCD panel **6** displays telephone calling or mail reception, date, time, etc. The lower enclosure **10** includes a key operation portion **9**.

**[0007]** In the foldable cellular phone as shown in FIG. 2, a wireless portion (transmission/reception circuit) for transmission/reception, a CPU for control execution, a memory such as a ROM and RAM are generally provided in the lower enclosure **10**. The CPU controls the display unit such as the main LCD panel **2** and camera provided in the upper enclosure **20** (see: JP-A-2003-198676).

**[0008]** In such a foldable cellular phone equipped with a camera, between the upper enclosure **20** and the lower enclosure **10**, signal wires between the camera and the CPU or memory are provided in addition to the signal wires between the display unit and CPU or memory. The cellular phone, therefore, presented a structural problem that the wire harness at the folding portion **30** is bulky.

**[0009]** Further, the image picked up by the camera is monitored on the display unit. For this purpose, the image must be updated at a high-speed rate (e.g. 15 frames/sec) to a certain degree. The camera has e.g. three and several thousands of pixels. The image is displayed in full color on the display screen of the display unit having a size of 176 dots (width)×220 dots (length). Thus, a large quantity of data is required for a camera image.

**[0010]** In a case where a game function is added to the foldable cellular phone, the CPU located in the lower enclosure **10** processes the data for the game function, and the display unit in the upper enclosure **20** displays the image as the processing result. A large quantity of data is also required for implementing the game function.

**[0011]** In this way, in order to process a huge quantity of data required for a function device (application device) such as the camera and game, the huge quantity of high speed signals (clocks, image data) pass through the wire harness of

the folding portion **30**. This presented a problem of an increase in power consumption owing to the capacitive load of the wire harness.

### SUMMARY OF THE INVENTION

**[0012]** In view of the above circumstance, an object of the present invention is to provide a portable communication terminal capable of implementing the function such as a camera and a game, which can reduce the number of signal wires connecting an upper enclosure (first enclosure) and a lower enclosure (second enclosure) thereby simplifying the wire harness of a coupling portion such as a folding portion and a revolving portion, and to reduce the quantity of communication between the upper enclosure and the lower enclosure thereby reducing power consumption.

**[0013]** The portable communication terminal according to a first aspect of the present invention is a portable communication terminal comprising;

**[0014]** a first enclosure including a function device for processing an image data, a first CPU for controlling the function device, and a first memory controlled by the first CPU; and

**[0015]** a second enclosure being mechanically and electrically connected to the first enclosure, the second enclosure including a transmission/reception circuit for performing communication between the terminal and the outside, a second CPU for controlling the transmission/reception circuit, and a second memory controlled by the second CPU.

**[0016]** The portable communication terminal according to a second aspect of the present invention is a portable communication terminal according to the first aspect of the present invention, further comprising:

a coupling portion for coupling the first enclosure and the second enclosure mechanically and electrically.

**[0017]** In the portable communication terminal, the image data may be subject to image compression processing before data transmission/reception containing the image data is carried out between the first enclosure and the second enclosure.

**[0018]** Further, when the communication is carried out between the terminal and the outside, data transmission/reception containing the image data may be enabled between the first enclosure and the second enclosure.

**[0019]** The portable communication terminal according to a third aspect of the present invention is a portable communication terminal according to the first or second aspect of the present invention, characterized in that the function device includes a camera module and a display module.

**[0020]** The portable communication terminal according to a fourth aspect of the present invention is a portable communication terminal according to any one of the first to third aspects of the present invention, characterized in that the first enclosure and the second enclosure are foldably coupled with each other at a folding portion.

**[0021]** The portable communication terminal according to a fifth aspect of the present invention is a portable communication terminal according to any one of the first to fourth aspects of the present invention, characterized in that

**[0022]** in the first enclosure, the function device, the first CPU and the first memory are coupled with one another through a first bus line;

**[0023]** in the second enclosure, the second CPU and the second memory are coupled with each other through a second bus line;

**[0024]** data transmission/reception between the first enclosure and the second enclosure is carried out between the first bus line and the second bus line through an input/output interface.

**[0025]** The portable communication terminal according to a sixth aspect of the present invention is a portable communication terminal according to any one of the first to fourth aspects of the present invention, characterized in that the first enclosure includes a media processor for serving a partial function including an image processing function of the first CPU.

**[0026]** The portable communication terminal according to a seventh aspect of the present invention is a portable communication terminal according to the sixth aspect of the present invention, characterized in that

**[0027]** in the first enclosure, the function device, the first CPU, the media processor and the first memory are coupled with one another through the first bus line;

**[0028]** in the second enclosure, the second CPU and the second memory are coupled with each other through the second bus line;

**[0029]** data transmission/reception between the first enclosure and the second enclosure is carried out between the first bus line and the second bus line through an input/output interface.

**[0030]** In accordance with the present invention, the first enclosure (upper enclosure) includes a first CPU for an application and a first memory for the application as well as a function device (application device), and the second enclosure (lower enclosure) includes a second CPU for communication and a second memory for communication as well as a transmission/reception circuit. Therefore, the data transfer in application processing is mainly carried out in the first enclosure. For this reason, as regards the application processing, the quantity of communication between the first enclosure and the second enclosure can be reduced.

**[0031]** Further, as regards the application processing; the width of the bus line (number of signal wires) connecting the first enclosure and the second enclosure is not almost a bottleneck, so that a large quantity of communication can be executed at a high speed in the first enclosure and the second enclosure. This facilitates the structure of a system for the application processing.

**[0032]** Further, since the quantity of communication between the first enclosure and the second enclosure is reduced, the width of the bus line (number of signal wires) connecting them is decreased, thereby downsizing the wire harness at the coupling portion such as the folding portion. This permits the production cost of the terminal to be reduced. Since the quantity of communication between the first enclosure and the second enclosure is reduced, the quantity of data passing the wire harness at a high speed at the coupling portion such as the folding portion is reduced, thereby reducing the power consumption owing to the capacitive load. The reduction in the number of the signal wires and power consumption is a great advantage for the portable communication terminal.

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[0033]** FIG. 1 is a view showing the configuration of a cellular telephone according to an embodiment of the present invention; and

**[0034]** FIG. 2 is a view showing the appearance of a general foldable cellular telephone.

#### DETAILED DESCRIPTION OF THE INVENTION

**[0035]** Now referring to the drawings, an explanation will be given of an embodiment of the portable communication terminal according to the present invention taking as an example a foldable cellular telephone. It should be noted that the present invention can be also applied to the other portable communication terminals than the foldable cellular telephone.

**[0036]** FIG. 1 is a view showing the configuration of the cellular telephone according to an embodiment of the present invention. As seen from FIG. 1, the cellular telephone includes an upper enclosure 20 which is a first enclosure, a lower enclosure 10 which is a second enclosure and a folding portion 30 which is a coupling portion for foldably coupling these enclosures. The appearance may be the same as the related-art cellular phone shown in FIG. 2. In FIG. 1, not shown are the antenna 1, high sensitivity mobile camera 3, positioning mirror 4, an LED (light emitting diode) 5 and subsidiary LCD panel 6. The main LCD panel 2 is included in an LCD module 21 and the key operation portion 9 corresponds to a key matrix 15.

**[0037]** As seen from FIG. 1, the lower enclosure 10 includes a transmission/reception circuit 11, a CPU 12 for communication (hereinafter referred to as C-CPU), an audio processor 13 for processing an audio signal, a memory 14 for communication which is a second memory, a key matrix 15, a key IF (interface circuit) 16, a power source circuit 17. The transmission/reception circuit 11 transmits/receives data and others through an antenna. The CPU 12 executes mainly the processing for a communication function of the cellular telephone. The power source circuit 17 supplies power to the respective components included in the upper enclosure 20 and lower enclosure 10, etc.

**[0038]** The memory 14 includes a volatile memory which is constructed of a static RAM serving as a work memory and others, and a non-volatile memory which is constructed of a flash memory for storing fixed information such as telephone numbers, mail addresses or a program. The audio processor 13 may be a DSP (digital signal processor). The transmission/reception circuit 11 is connected to the C-CPU 12 and audio processor 13. The volatile memory may be incorporated in the C-CPU 12.

**[0039]** The function of the audio processor 13 may be given to the C-CPU 12. In this case, the audio processor 13 is not required. Further, the transmission/reception of data and others between the terminal and the outside is executed by wireless through the antenna, but may be executed by wire communication.

**[0040]** The C-CPU 12, audio processor 13 and memory 14 are connected to a first bus line BUS-1. The key matrix 15 is also connected to the first bus line BUS-1 through the key IF 16. The first bus line BUS-1 is connected to a first I/O (input/output) IF 19 through which the data are transferred to/from the upper enclosure 20.

**[0041]** The C-CPU 12 also deal with a key operating signal from the key matrix 15, a calling signal and other control signals, and transmits a necessary signal to the upper enclosure 20. Further, the C-CPU 12 preferably has a function of executing the processing of supplying the image data (e.g. still or static image data) from the upper enclosure 20 to the transmission/reception circuit 11, and transmitting the image

data (e.g. still or static image data) received through the transmission/reception circuit **11** to the upper enclosure **20**. In the following description, although it is assumed that the image data is the still image data, the still image data may include the image data with less updating frequency (e.g. image updated at a low speed rate of 10 frame/sec or less).

**[0042]** The upper enclosure **20** includes an LCD module **21**, a display IF (interface) **22**, a camera module **23**, a camera IF (interface) **24**, a CPU **25** for application (hereinafter referred to as A-CPU), a media processor **26**, a memory **27** for application which is a first memory, etc. The LCD module **21** is a display module having a display panel and a driver for the display panel. The camera module **23** is an image pick-up module having a camera and a driver for the camera. The CPU **25** is a first CPU for controlling mainly the function device (application device) such as the LCD module **21** and the camera module **23**. The media processor **26** serves a partial function (e.g. image compression processing) including the image processing function of the A-CPU.

**[0043]** The memory **27** includes a volatile memory which is constructed of a static RAM serving as a work memory and others, and a non-volatile memory which is constructed of a flash memory for storing fixed information such as a program. Since the memory **27** serves as the work memory, the image data picked up by the camera module **23** are once stored in the memory **27**. The image data stored are subjected to required adjustment as the occasion demands and thereafter read out. The image data thus read are supplied to the LCD module **21** and the lower enclosure **10**.

**[0044]** Incidentally, the function of the media processor **26** can be given to the A-CPU **25**. In this case, the media processor **26** is not required.

**[0045]** The LCD module **21** is connected to a second bus line BUS-2 through the display IF **22**. The camera module **23** is also connected to the second bus line BUS-2 through the camera IF **24**. Further, the A-CPU **25**, media processor **26** and memory **27** are also connected to the second bus line BUS-2. The second bus line BUS-2 is connected to a second I/O IF **29** through which data are transferred from/to the lower enclosure **10**.

**[0046]** The folding portion **30** couples the lower enclosure **10** and the upper enclosure **20** with each other using a plurality of signal wires, thereby foldably coupling these enclosures. These signal wires are preferably formed as a wire harness **31**.

**[0047]** An explanation will be given of the operation of the foldable cellular telephone shown in FIG. 1. First, in a case where an object is picked up using the camera module **23**, by operating the key matrix **23**, image pick-up instructing information is supplied to the camera module **23**. Then, the camera module **23** start picking up the image. The image pick-up instructing information may be supplied to the camera module **23** through the C-CPU **12** and A-CPU **23** from the key matrix **15**, otherwise may be directly supplied to the camera module **23**.

**[0048]** The image data picked up by the camera module **23** are once stored in the memory **27**. The image data stored are subjected to required adjustment as the occasion demands and thereafter read out. The image data thus read are displayed on the LCD module **21**.

**[0049]** The storage of the image data in the memory **27** and the display of the image data on the LCD module **21** are executed under the control by the A-CPU **25**. The image data

are updated at a high speed rate to a certain degree (e.g. 15 frames/sec) for its monitoring on the LCD module **21**.

**[0050]** During the image pick-up by the camera module **23** and image display on the LCD module **21**, the processing of the image data updated at a high speed rate is executed only inside the upper enclosure **20** including the A-CPU **25**, memory **27**, etc. Therefore, the C-CPU **12** is not required to share the processing of the image data.

**[0051]** In this case, unlike the related-art cellular telephone, the folding portion **30** is not required to transfer the image data at a high speed (in real time) from the camera module **23** in the upper enclosure **20** to the CPU in the lower enclosure **10**, and from the CPU in the lower enclosure **10** to the camera module **23** in the upper enclosure **20**. For this reason, the number of the signal wires of the folding portion **30** can be reduced by adopting e.g. serial communication, thereby downsizing the wire harness **31**. Further, the quantity of data passing the wire harness **31** can be greatly reduced, thereby reducing power consumption.

**[0052]** Next, in a case where the image picked up by the camera module **23** and displayed on the LCD module **21** is transferred to a communication party on the other side, when the image to be transferred is displayed on the LCD module **21**, image transfer instructing information is supplied to the A-CPU **25** by operating the key matrix **15**. Under the control by the A-CPU **25**, the image data stored in the memory **27** is first transferred to the side of the lower enclosure **10**. In transferring the image data, the image data is preferably subjected to the data reduction processing such as the image compressing processing by the media processor **26** before it is transferred.

**[0053]** On the side of the lower enclosure **10**, the image data transferred are transferred to a communication party on the outside from the transmission/reception circuit **11** based on the control C-CPU **12**. If the image to be transferred is the still image or image data with less updating frequency, the transfer can be done with less burden.

**[0054]** An explanation will be given of the case where a user plays a game while seeing the screen of the LCD module **21**. The data necessary for playing the game are previously stored in the memory **27**. Therefore, from the lower enclosure **10**, by operating the key matrix **15**, a command signal is supplied to the A-CPU **25** through the folding portion **30**. In accordance with the command signal, the A-CPU **25** reads the program data or other data stored in the memory **27**, and controls the image display on the LCD module **21** on the basis of the data thus read.

**[0055]** In this way, in the case of playing the game, the high-speed data processing and the high-speed data transfer on the basis of the processed data are carried out only inside the upper enclosure **20**. Thus, also in the case of playing the game, the quantity of data passing the folding portion and its bus line width can be extremely reduced.

**[0056]** In a case where the communication data containing the image data are transferred from the communicating party on the outside, first, the transmission/reception circuit **11** receives the communication data. Then, the C-CPU **12** and audio processor **13** processes the communication data thus received. The fact that the communication data containing the image data have been received is reported to the A-CPU **25** through the folding portion **30**. Simultaneously, the received image data, after compression processed, are transferred to the A-CPU **25** through the folding portion **30**. The image thus

received is displayed on the LCD module **21**. The image received is also a still image or the image with less updating frequency.

**[0057]** As understood from the above description, the data transferred between the lower enclosure **10** and the upper enclosure **20** are, in both transfer directions, the still image data or compressed image data, key entry signals and other control signals. For this reason, unlike the related-art cellular phone, it is not necessary to transfer, through the wire harness **31** of the folding portion **31**, the image (picked-up image or game image) updated at a high-speed rate for monitoring. Thus, the power consumption will not be increased owing to the capacitive load of the wire harness **31** of the folding portion **30**. The number of components for noise countermeasure can also be reduced. Only when the image data containing the still image is transferred between the lower enclosure **10** and the upper enclosure **20**, the data transfer can be executed between the lower enclosure **10** and the upper enclosure **20**. Thus, the transmission/reception and display of the image data and other data can be done surely with no hindrance.

**[0058]** In the description hitherto made, the operation of the LED display and subsidiary LCD panel was not explained. In their operation, however, in response to e.g. telephone calling, a small quantity of data such as calling or mail receiving information, date, time, etc., is only transferred at a low speed. This is not problematic at the folding portion **31**.

**[0059]** In the embodiment, the display panel was constructed of the LCD display panel. However, the portable

communication terminal according to the present invention can be also designed using the other display device such as an organic E/L display panel. Further, the present invention can be applied to not only the folding structure described in connection with the embodiment but also a structure in which the lower enclosure and upper enclosure are revolved.

**[0060]** It will be apparent to those skilled in the art that various modifications and variations can be made to the described preferred embodiments of the present invention without departing from the spirit or scope of the invention. Thus, it is intended that the present invention cover all modifications and variations of this invention consistent with the scope of the appended claims and their equivalents.

1. A portable communication terminal comprising;
  - a first enclosure including a function device for processing an image data, a first CPU for controlling said function device, and a first memory controlled by said first CPU; and
  - a second enclosure being mechanically and electrically connected to the first enclosure, the second enclosure including a transmission/reception circuit for performing communication between the terminal and the outside, a second CPU for controlling said transmission/reception circuit, and a second memory controlled by said second CPU.
- 2-9. (canceled)

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