Human-Friendly UI Design for "Cloud Communicator"

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Abstract

The line of Cloud Communicators consists of three products designed according to specific scenarios of usage, and a UI based on the concept of human-friendliness designed to match the scenarios of usage of each product. The single-screen "Cloud Communicator LT-S" features a human-friendly UI using a touchscreen panel with pen-input capability. The dual-screen display tablet PC, "Cloud Communicator LT-W," uses a new UI inspired by its book-style design. Finally, the "Cloud Communicator LT-N" uses a UI suitable for communication using the touchscreen panel as well as the character input via the integrated hardware keyboard.

Keywords

cloud, terminal, Android, dual-screen display, keyboard
pen input, 7-inch, touchscreen panel, book style, usability

1. Introduction

The Cloud Communicators are new terminals equipped with the characteristics of existing terminals such as PCs and cellular phones and can be positioned in a category between them. Their basic features include high-speed communication, high expressive power, large screen (7-inch), mobility, power saving, permanent activation and touchscreen control panel. NEC is attempting to link the Cloud Communicators with cloud-computing services for corporate customers to create new scenarios of usage, new services and new businesses.

The line of Cloud Communicators consists of three products designed according to different scenarios of usage. The first is the single-screen type assuming scenarios of usage in which both easy visibility and portability are required. The second is the dual-screen book-style type that assumes scenarios of usage in which the terminal is carried folded or closed like a day planner. The third is a notebook PC-type terminal equipped with a hardware keyboard. It assumes scenarios of usage in which communication is held based on keyboard input.

The Cloud Communicator terminals aim to be usable by anyone in the age of cloud computing by interlocking with the customer services of various enterprises. To maintain their high usability in the assumed scenarios of usage, their UIs are designed to be user-friendly or human-friendly. This paper introduces these human-friendly UI designs of the Cloud Communicators.

2. Human–Friendly UI Design for Single–Screen Cloud Communicator LT–S

2.1 Product Concept of Single–screen Cloud Communicator LT–S

We conducted a market survey before the development of these new terminals and found that many consumer-oriented services using the Internet are conceivable in many fields and that there is a great need for using them among the beginner-class users. All of the main scenarios of usage of the terminals were "various household services that can be utilized by anyone."

Consequently, we set the concept of the single-screen Cloud Communicator LT-S (**Photo 1**) to "a terminal that is human-friendly, amiable and usable by anyone." For this purpose, we decided to pursue a "human-friendly" UI for direct interfacing with the user so that this terminal can be utilized actively in all users' daily lives.

The single-screen Cloud Communicator LT-S is positioned as a general-purpose terminal featuring higher mobility than the PC, instant start-up, a 7-inch LCD that is larger and easier-to-view than the cellular phone, and which can be customized in response to various user needs.

Human-Friendly UI Design for "Cloud Communicator"

Photo 1 Human-friendly UI design for single-screen Cloud Communicator LT-S.

2.2 UI Design for Single–screen Cloud Communicator LT–S

With Cloud Communicator LT-S, we designed the UI to support users of a broad set of ages and wide range of scenarios of usage based on the product concept of the tablet.

For instance, the scenarios of usages we assumed include the following.

1) As a terminal for receiving information distribution services at home.

2) As a terminal for home power monitoring or home appliance control for ecological purposes.

3) As a home terminal for Internet shopping.

Since the point common to these scenarios lies in allowing the terminal to be used by people unfamiliar with IT such as aged people, the single-screen Cloud Communicator LT-S emphasizes portability and the UI's simple, intuitive means of input.

(1) Resistive touchscreen

The touchscreen panel features intuitive interface, and was specifically engineered to enable various kinds of stress-free input. The Cloud Communicator LT-S terminal features a resistive touchscreen that allows input using pen, fingernail or fingertip, even when the user is wearing gloves. It also features a reduction of the resistive film contact pressure to provide a light touch like a capacitive touchscreen in spite of being a resistive touchscreen. To make this possible, we not only improved the touchscreen physically but also designed a unique algorithm that offers a light touch, high input accuracy and advanced tracking ability.

The terminal incorporates a stylus pen embedded in the back panel that has been designed to maximize the ease of detaching.

(2) Overall design

To manifest "friendliness," the terminal is designed to resemble a book and features book metaphors (designs like the page-flipping sides of a book) on its sides.

Instead of sharp corners and angles, the device features natural design that looks at home on a sofa and blends in well in a living room. The keyword of its functionality design is "asymmetry."

When a terminal with small margins around the LCD monitor is held by one hand, the display may become hard to view because the fingers holding the terminal may hide the screen. To deal with this problem, we laid out the LCD monitor asymmetrically in both the vertical and horizontal directions to reserve the holding areas around the screen frame so that the fingers do not hide the screen when holding the terminal.

(3) Slip-free edging

Considering the case in which the terminal placed horizontally on a desktop is picked up by hand, we set the ease of picking up as an important feature of the UI.

We accomplished this by giving the terminal a tapered shape (the boat-form edges of the side panels), and indented surfaces of the sections that resemble a book. In addition, to ensure the ease of holding after picking up and to prevent slipping, the edges of the book-like sections are designed with tapered shapes and indents (**Fig. 1**).

A lightweight body that can be supported with one hand is one of the basic requirements of mobile equipment and also an important factor for usability. The Cloud Communicator LT-S retains enough rigidity without using a metallic frame inside to give the body a light weight of about 370 grams.

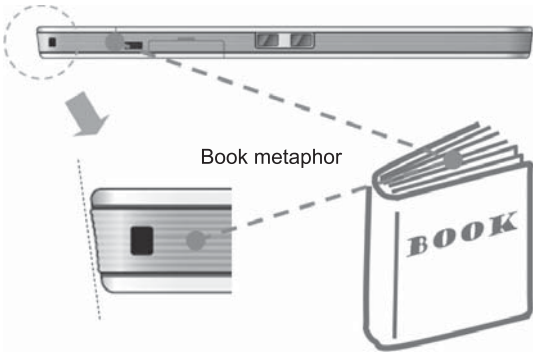

Fig. 1 Enlarged view of book metaphor section.

Furthermore, to prevent damage to the flat rear panel during use in a horizontal position on a desktop, the terminal is equipped with elastomeric cap feet that prevent it from rubbing against the desk surface.

(4) Large-sized buttons

The Return, Menu and Home buttons, which are indispensable for the control of Android, are positioned in order of frequency of use assuming that they are pushed with the left hand (**Photo 2**). The right hand is assumed to be used to control the touchscreen panel or hold the pen for input.

A version with cursor buttons and another without cursor buttons have been prepared (Photo 2) to meet the many needs of a wide variety of users. In addition, the terminal is designed to allow customization of button layout so that it can be adapted to meet as many customer requirements as possible.

The large buttons have been given a size that can be used safely by senior persons and have been placed at optimum intervals.

(5) Cursor buttons

Web browsing requires control of hyperlinks and menus that are accessed by clicking the mouse on them. When links with high character density are positioned adjacently, a fingertip on the touchscreen control panel may have difficulty selecting them.

The control can be made easy by magnifying each page to increase the intervals between links, but this would make it hard to understand the overall layout of the page.

Photo 2 Button layout of Cloud Communicator LT-S.

Therefore, in the case in which the stylus pen cannot be used, we also installed cursor buttons as another means of input capable of intuitive control.

The cursor buttons can also be used to scroll or select OS menus step by step. Turning the page of an ebook is also possible using the cursor buttons.

As described above, the cursor buttons are provided as a UI supplementing the touchscreen control panel to improve usability.

(6) Full-sized standard SD card slot

Assuming the usage in which data saved with a PC or pictures taken with a digital camera are viewed on the Cloud Communicator LT-S, we installed a standard SD card slot in the terminal.

The standard full-sized SD card slot uses the same card as the standard SD cards used with general digital cameras. This improves usability because the data can be exchanged without conversion using an adapter, as opposed to a microSD card used by many different mobile terminals.

In addition to the UI design of the hardware, human-friendly software such as “Easy Wireless Start” has also been developed and is provided as standard for easy wireless LAN setting.

3. New UI Design for Dual–Screen Display of Cloud Communicator LT–W

3.1 Product concept of Cloud Communicator LT–W

One of the representative actions people take while being out is reading a book.

Photo 3 Cloud Communicator LT-W dual-screen display terminal.

The Cloud Communicator LT-W (**Photo 3**) has two 7-inch screens capable of displaying a page on each screen just like when you open a book. Each screen size is almost as same as the page size of a Japanese paperback. To provide the terminal with portability, it is positioned as a book-style terminal whose two screens can be folded for easy carrying.

The assumed scenarios of usage of the book-style terminal include a businessperson reading a newspaper or book while commuting on the train and a salesperson storing thick catalogues in the terminal for later viewing or using the terminal as an order-receiving terminal for handwritten input. As the posture of the user resembles holding an open book in these applications, we emphasize the "ease of holding," "ease of opening" and "ease of reading" for the UI of the book-style terminal.

3.2 UI Design for Hardware

In addition to inheriting the human-friendly UI design of the single-screen Cloud Communicator LT-S such as the capability of pen input on the resistive touchscreen and cursor button input, we implemented the UI as described below for the dual-screen display terminal.

(1) Folding design

With the Cloud Communicator LT-W, a book-style terminal, we implemented the "ease of holding," "ease of opening" and "ease of reading" required for reading a book. For the "ease of holding," the section corresponding to the spine of a book is flattened (**Photo 4**) and part of the cabinet to reduce the angulated touch during holding is tapered (**Photo 5**).

The "ease of opening" is achieved by providing a projected part for hooking the finger when opening the terminal, and the "ease of reading" is achieved by using LCD panels with wide viewing angles to support reading the opened terminal like a book.

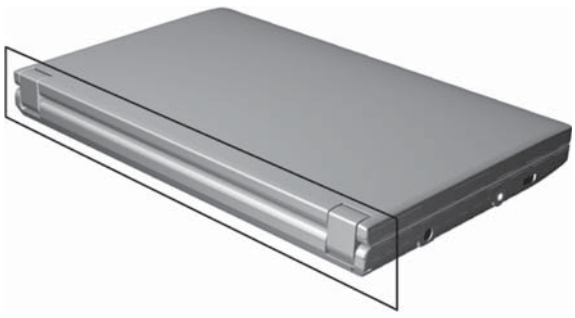

Photo 4 Flattening of spine section by reducing projections of hinges.

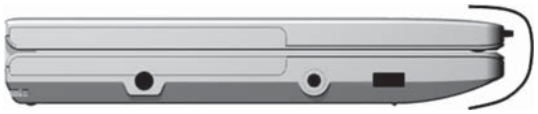

Photo 5 Improved ease of holding thanks to tapered cabinet (On the right of illustration).

(2) Hinges

Since the terminal is always opened and closed before and after use, the hinges are designed specially to implement "narrow frame" and "full flatness."

The "narrow frame" ensures a minimization of the distance between two LCD panels by positioning the hinges in a special manner for when the two screens are used like a single screen. The "full flatness" refers to making the LCD surfaces flat when the terminal is opened by 180° by means of biaxial hinges.

This design is a result of the consideration that, since both screens of the terminal can be controlled with a stylus pen, operability will be improved by avoiding anything that could be an obstacle around the LCD panels.

At the beginning of development single-axis hinges were selected, but they protruded and appeared on the LCD panel side when the terminal was closed. So we decided to adopt biaxial hinges so that the LCD panels become flat when the terminal is opened 180°.

(3) Button layout

1) Layout for facilitating right-handed button operation when the terminal is held with two hands

When it is assumed that the terminal is used in a scene in which it is read like a book while the user is seated on the train, the user's left hand holds the cover surfaces of the opened terminal as if supporting it, and the right hand is placed on the right side of the terminal. At this time, if the Turn Page button is placed on the position of the right hand, that is, on the bottom right of the terminal, the button can be pressed without moving the right hand away from the terminal. Therefore, the buttons are laid out in order of priority from the position most easily accessible by the right thumb.

2) Volume buttons accessible when the terminal is closed

One of the scenarios of usage of the Cloud Communicator LT-W is as a learning device. The user may read a text-

book or study guide, or listen to an audio book or foreign language teaching material during the commute to office or school.

In the latter case, the terminal is mostly placed in a bag or similar enclosure in the closed position. To enable the adjustment of audio volume without opening the terminal, the volume button is located on the outer side of the closed terminal.

3.3 Dual–screen Display Framework

We designed a framework to determine the usages proper to a book-style terminal with dual screens.

(1) Left/right separate function allotment

This terminal has two screens, and the ease of understanding can be improved by displaying different items of information separately on the left and right screens rather than splitting one screen into two. This may be applicable to the following types of information.

1) Thumbnail display of multiple pictures and full-screen display of the selected picture.
2) Full-page display and partially magnified display of a newspaper page.
3) Before use/after use display
4) Display-dedicated screen and input-dedicated screen.

(2) Single-screen mode

When a large amount of information is required, this mode makes it possible to use the two screens as a single large screen.

(3) Examples of use of dual-screen mode

The characteristics of the two screens with the two-page spread viewing capability and book-style terminal make it possible to implement the following book/learning services (**Photo 6**).

1) Lecture movie and learning text.
2) Two learning texts.
3) Webpage and learning text.
4) Table of contents and learning text.

We designed this terminal to be capable of laying out and displaying different content on each of the two screens because this can facilitate the understanding of different types of content and improve the efficiency of self-study. We will measure user satisfaction continually to further improve the user-centered design of our products.

Photo 6 Example of use of dual-screen mode.

4. UI Design Suitable for Text–Based Communication of Cloud Communicator LT–N

4.1 Product Concept of Cloud Communicator LT–N

Smartphone is one of the current devices which is often used for the Internet communication while they are out. On our questionnaire and group interviews of smartphone users, they told the biggest dissatisfaction was the difficulty of character input. The difficulty of character input by using the software keyboard on a small screen causes users to be passive, exclusively receiving one-way information without originating communication from themselves.

Therefore, we decided to adopt Android for the Cloud Communicator LT-N terminal (**Photo 7**) to provide it with the advantages of smartphones, such as quick activation and long hours of use. At the same time, we solved the dissatisfaction related to the character input and commercialized it under the concept of "a terminal that can comfortably hold Internet communication mainly based on character input, such as email, blogging and SNS, even outside the home or office."

4.2 UI Design Suitable for Character–input

We adopted a hardware keyboard as the character input UI. Its features are enumerated as below (**Fig. 2**).

(1) Same key layout that PC users are familiar with in offices, homes and schools allows them to input/convert data

Human-Friendly UI Design for “Cloud Communicator”

Photo 7　Cloud Communicator LT-N.

Fig. 2　Features of keyboard.

without learning how to use the key operation again.

(2) The key pitch of 16.8 mm on a compact body with a 234 mm width enables touch typing.

(3) Keys have a pantograph structure with a stroke of 1.6 mm.

(4) To allow users to type in their accustomed way, the key positions of Ctrl, Fn amd Menu key that often change positions among terminals, are exchangeable.

(5) Frequently used Android operation keys are equipped as dedicated ones, and the Menu key used as a shortcut is positiond on the left side.

In addition, users can input sentences efficiently with the UI using PC layout keyboard, such as changing a phrase position with the cursor key or converting the words again with the functions keys, when converting Japanese.

4.3 UI Design of Life Note

The Life Note is an application developed independently for comfortable communication by using letters (**Fig. 3**). This application makes it possible to write down what users think or see, then send email/blog/SNS easily with attached images.

(1) Comfortable input environment utilizing keyboard

In addition to the shortcut keys frequently used with the PC such as “Ctrl+C” (copy) and “Ctrl+V” (paste), original shortcut keys are added be set to enable control of any function without releasing hands from the keyboard.

(2) UI that does not make conscious of file management

The UI of the Life Note displays all of the composed texts in series, like on a scroll, without dividing them into files. This is because performing file management like a PC is very troublesome for Android, which uses a single window and a low display resolution. Furthermore, considering a usage scenario which users write texts little by little in their free time, usability can be improved without notifying them of saving and loading files.

The creation of files inside the application and the running of save/load as internal processing operations allow users to start new text just like taking a memo in a notebook, by simply inserting a delimiter in the text, without performing operations such as save/load. Texts composed in the past can be edited directly by scrolling the list upward.

(3) UI for communication service posting

To post a text in a blog/SNS from a PC, it is necessary to log in to the service in a browser, then compose the text and post it. Meanwhile, the UI of the Life Note makes it possible to post a previously composed text directly to a blog/SNS with

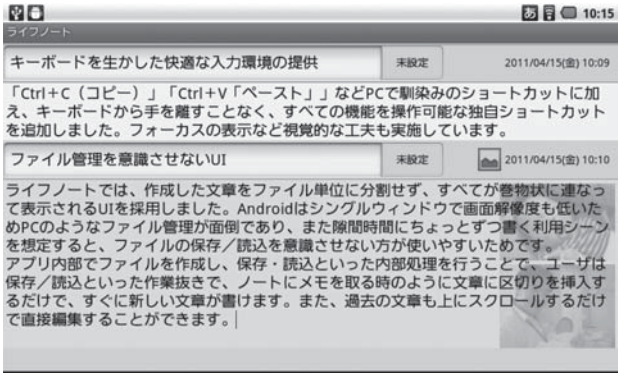

Fig. 3　Input Screen of Life Note.

one-touch operation just like sending an email. To make this possible, we embedded XML-RPC API, Atom API, etc. according to the specifications of each blog/SNS and packaged a mechanism enabling advance registration of account information in the software.

5. Conclusion

To provide the Cloud Communicator LT-N terminals with high usability for all potential scenarios of usage, we designed various UIs for a variety of situations. We believe that the provision of new services with these terminals will help even those with limited computer skills and make the affluent age of cloud computing accessible to everyone.

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Vol.6 No.2

July, 2011

Special Issue TOP