Innovative ATM Development Pursues Usability and Environmental Performance from the Viewpoint of the Customer

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Abstract

Seven Bank, Ltd. and the NEC Group have co-developed an innovative ATM (automated teller machine) and started to introduce it to the shops in March, 2011. This new type of ATM has pursued better usability and a superior environmental performance from the viewpoint of the user. It has been developed under a process that employs user-centered design concepts in order to achieve a product that will enable a variety of users, including persons with visual impairments or those from overseas countries, to use the machine safely and securely. At the same time, we have aimed to develop a product that is environmentally friendly.

Keywords

user-centered design (UCD), design, universal design (UD), user evaluation
prototype, accessibility

1. Introduction

Seven Bank, Ltd. (hereinafter referred to as Seven Bank) and the NEC Group have co-developed an innovative ATM (hereinafter referred to as 3G ATM: the 3rd Generation ATM) in accordance with user-centered design (UCD) concepts that is to be installed at the shops of Seven-Eleven and ITO-Yokado. In November, 2010, installation on a trial basis was started and since March, 2011, the actual installations and replacements of new machines have been carried out.

This paper introduces the NEC Group's approach to the 3G ATM developed with UCD concepts, in cooperation with Seven Bank.

2. Development with UCD Concepts

NEC Design & Promotion has promoted the development process in accordance with the UCD concept in order to realize hardware and software of superior usability. We have also conducted user evaluations in cooperation with our relevant departments and also with staff from Seven Bank.

Employing the UCD process has enabled a user-friendly universal design (UD) as well as improved usability and accessibility so that more users can comfortably enjoy our products and services.

2.1 Collecting and Understanding User Information and Conducting User Evaluations

Before starting the development of a 3G ATM, we conducted in-depth observation and user evaluation of 2G ATM in order to obtain a better understanding and graph of available user information. Our evaluation examined operability of existing machines from the standpoints of both hardware and software (**Photo 1**).

The evaluations have been conducted in situations in which users were asked to operate an ATM installed at a shop and to list several operational issues from the aspects of "easy-to-use," "not easy-to-use" and "needs to be improved," etc. The results of the user evaluations were treated as important user information and were employed to support the subsequent development of the new 3G ATMs.

2.2 Clarifying the Goal of 3G ATM

While the results of the above-mentioned user evaluation revealed that 2G ATMs are favorably evaluated by users with

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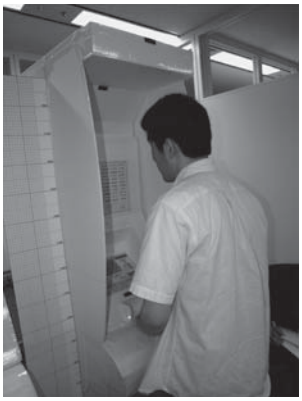
Photo 1 User evaluations using a 2G ATM.



Evaluation by a completely blind person

Evaluation by a person using a wheel chair

Photo 2 Evaluation using a low fidelity paper prototype.

visual impairments and visitors from overseas, we were also able to gather critical feedback from wheelchair users, the elderly and first-time ATM users and set objectives for the development of the 3G ATM machines that will make them easier, safer and more secure to use for a broader range of users.

3. Hardware Development and User–Centered Design (UCD)

In order to achieve the goal of the new 3G ATM, we have developed the requisite hardware by employing UCD concepts.

3.1 Design Examination Using a Prototype

First of all, we made a full size low fidelity paper prototype so that designers, engineers, planners, and sales staff as well as staff from Seven Bank could all share in the product information and images. We then examined the ideas and designs assigned to the product for achieving usability (**Photo 2**).

Even from this early stage of the development process, we began to examine usability not only from the perspective of the ATM users but also from that of the ATM maintenance staff.

While considering the results of the user evaluations, we have provided many provisional sketches based on the full-size paper prototypes and have thereby improved our ideas regarding operability and usability.

We first try to generate ideas as much as possible to cover a variety of issues from those of the entire ATM machine design to the positions and appearances of individual displays. These include the operations displays and secondary displays

Photo 3 Paper prototypes for detail evaluations.

(displays that appear on top of the operations displays to inform of messages or campaigns from the bank) as well as ideas aimed at achieving UD concepts.

Next, we arranged and integrated our ideas in a prioritized manner. Then, we narrowed our objectives for achieving the goal and created several prototypes for examining our ideas. We then conducted user evaluations aimed at further product enhancements (**Photo 3**).

3.2 Strengthening Security for Safe and Secure Operation

We have examined the product designs that aim to enhance privacy protection. Changing the position and the angle of the operation display has made it possible to double the enclosed space protected by the side partitions (**Fig. 1**).

In order to enable user operation even more safely, we then developed a new function equipped with a detection sensor. This function detects any items including a bank card, notes, etc. left behind by a user of the ATM and a voice announcement alerts the user and announces "Please check that you have all your belongings." A second speaker has also been installed to provide even clearer announcements. Moreover, to enhance security further, a camera has been newly installed at the top of the ATM to record a situation when a user has left things behind or if any emergency event occurs (**Fig. 2**).

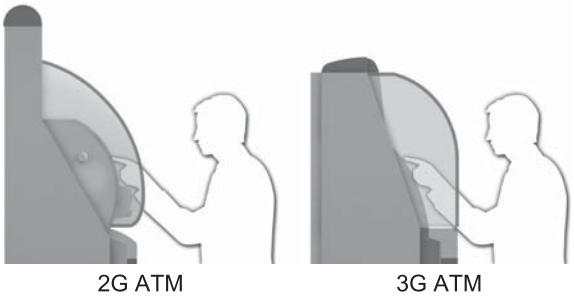


Fig. 1 The enclosed space protected by the side partitions was doubled.

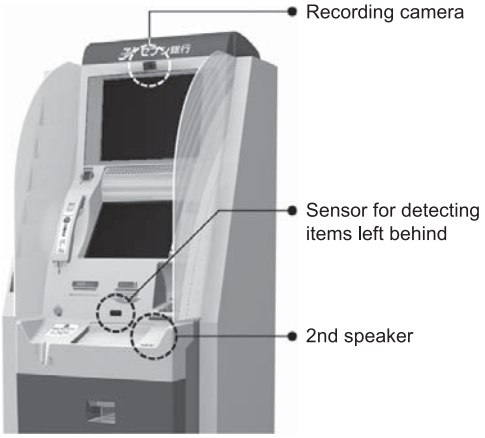


Fig. 2 New function installed on 3G ATM.

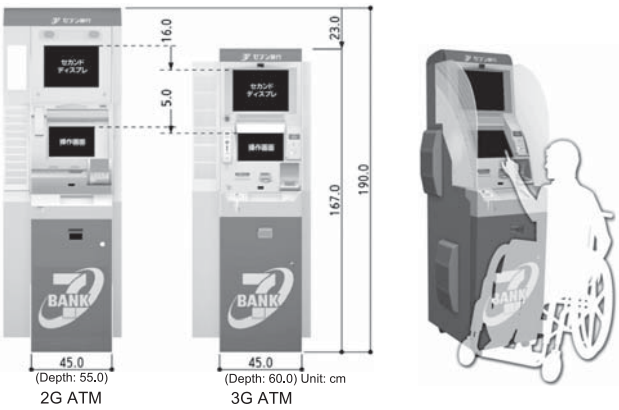


Fig. 3 An even more compact ATM with better usability.

3.3 Consideration for Wheel Chairs Users

The conventional 2G ATM was developed with a compact design. However, the 3G ATM is even more compact with its height being 23 cm less than that of the 2G ATM.

In order to provide better usability to persons with wheel chairs, the visibility and operability have been improved by installing an operation display, an interphone and input buttons, at lower positions on the ATM (**Fig. 3**).

4. Software Development and UCD

The software has also been developed under a process employing UCD concepts.

4.1 Services for Visually Impaired Users (Voice Guidance Service)

The voice guidance service for visually impaired users was developed to be mounted in 2G ATMs and the service has been successfully transferred to the 3G ATMs. The development process of the voice guidance service for 2G ATMs is explained below.

1) Understand and specify the context of use

Questionnaires and interviews were arranged with completely blind persons and with persons with weak eyesight who were selected from the UD monitoring group organized by NEC Design & Promotion. Through these surveys, we have studied the usage conditions of visually impaired persons and

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also their requests for ATM operations.

2) Specify the user requirements

Our goal is to develop an ATM that visually impaired users are able to operate using an interphone equipped with hardware keys so that they do not have to operate a touch-panel screen. In order to achieve this, a system operated by linking the voice guidance service and a call center was developed.

3) Produce design solutions to meet user requirements

The voice guidance service was examined by clarifying the priority of the information required for the ATM operation, so that users could operate the ATM efficiently. At the same time, as a method to prevent interference or malicious operation by a third party, a function was provided so that the touch-panel or ten-key operation on the ATM was disabled when operation via an interphone was selected.

4) Evaluate the designs against requirements

After implementing the examined details of the voice guidance service onto the ATM to be installed at shops, user evaluation was conducted by visually impaired persons. The following evaluations were checked: understandability of the guidance flow, hearing capability of the voice guidance and adequacy of the voice guidance speed (**Photo 4**). Further improvements were provided by examining the issues revealed by the evaluations.

Photo 4 User evaluation of the voice guidance service.

Fig. 4 Display samples with Chinese, Korean and Portuguese.

4.2 Services for Users from Overseas Countries (Multi–language service)

In order that more persons from overseas countries are enabled to use our ATMs comfortably, 2G ATM has been developed to handle over 4 billion overseas issued credit and bank cards and this service has been transferred seamlessly to the 3G ATMs.

The operation is prepared in four languages (English, Korean, Chinese and Portuguese) as shown in **Fig. 4** , and the ATM receipt is issued in the selected language.

4.3 User–Friendly Services Offering Better Usability for Even More Users

1) Human-friendly UD fonts

Japan is facing an ultra-elderly society that consists of over 65 year olds people (one in four females and one in five males). According to this accelerating trend, the number of users with impaired eyesight will inevitably increase.

To cope with this issue, we have changed the display fonts from the conventional ones to the NEC's original UD font (FA UD gothic) that had characteristics of better visibility and readability even for users whose eyesight is impaired (**Fig. 5**).

Fig. 5 Display screen of NEC original UD fonts (FA UD gothic).

2) Display design

Improvements in how the information is communicated in text, i.e., easier-to-understand sentence structure, vocabulary choice, etc., on the operation screen or other display screens have been carried out so that users can operate the ATM smoothly with fewer concerns.

3) Smooth and easy display switching

Some functional effects are provided to switch the display screens so that users can operate various functions smoothly and confidently. These include the relocation of the page advancement function button to the bottom of the display screen.

4) Sound effects for button pressing, etc.

Sound effects have been greatly improved in order to encourage pleasant, safe and secure operations. Further sound effects and voice guidance have been developed in order to discourage users from leaving things behind. Moreover, sound effects for voice guidance of the entire operation process, button pressing, display changes, etc. has been reviewed to develop even more effective sounds to suit each of the operational situations.

For example: a soft start-up sound precedes the voice guidance, preparing the user to listen to the instructions. The "Confirm Button" is accompanied by a sound that both assures the user that operation is progressing and cues a sense of achievement. Other standard buttons are provided with sounds that evoke a gentle and open image. "Alert" sound effects are designed to be gentle at first, but become subsequently stronger. These and other audio cue principles were identified and applied in the improvement of the ATM aural experience.

5. Other Features Provided for the 3G ATM

While listening to the opinions of users that are currently using 1G and 2G ATMs, the 3G ATMs have been developed in order to pursue the usability and environmental performance from the viewpoint of the user.

Besides the features of 3G ATM explained so far, features concerning environmental performance are prepared as follows.

(1) Improving the speed of ATM operations

The following three issues have been improved compared to those of the 2G ATM to achieve speedy ATM operation.

1) Improvement of the notes processing speed (improved from 6 notes per sec. to 12 notes per sec.)

2) The stand-by time for resuming operation from the eco mode is reduced to 0 (zero) seconds from 7.6 seconds.

3) Preparation time to shift to the next transaction after completion of one transaction is reduced from 9.5 sec. to 2.8 sec. This has resulted in an increase in the number of available transactions from 80 per hour to 100 per hour.

(2) Enhancement of cash transactions

The cost of filling up cash in an ATM is reduced by increasing the volume of the cash storage capacity of the ATM. Moreover, flexible cash storing management is now available according to the ATM location and the usage conditions, by employing cash cassettes of larger capacity, so that a shortage of cash storage is thereby prevented.

(3) Providing environmental considerations

ATMs are operated under the eco mode during hours outside of the service hours. The display backlights have been replaced with LEDs. Power consumption has been reduced to almost half that of the conventional models. Parts with a long-service life that use recyclable materials have been adopted in order to promote efficient resource usage. Our approach to these issues has won praise from the Green IT Promotion Council. In addition the Seven Bank's 3G ATM received the Jury's Special Awards of the Green IT Award 2010 in the category of "Energy Saving Information Technology."

6. Conclusion

We are aiming to develop ATMs that provide better usability with safe and secure operation. At the same time, we will develop an environmentally friendly ATM that meets another

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of our goals by achieving the NEC Group's Vision 2017 "To be a leading global company leveraging the power of innovation to realize an information society friendly to humans and the earth."

In cooperation with Seven Bank, the NEC Group will contribute to society via ATM innovation that is friendly both to humans and to the earth.

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