Development of DCMSTORE-POS, a POS System for Mass Retailers Based on Human-Centered Design

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Abstract

DCMSTORE-POS is a POS system for mass retailers such as food supermarkets. Previous POS systems have faced challenges with issues reported by customers such as "old-fashioned display" and "bad reputation on usability with field workers." To solve these problems, the authors attempted to identify issues, analyze workflow, evaluate the results and exchange opinions by organizing a project that includes usability specialists as well as planners, sales engineers and developers who observe the field of use of POS systems. As a result, the authors succeeded in developing a new system that can satisfy both users and managers through a display with easily viewable colors, legible characters and improved operating efficiency thanks to a reduced number of control steps.

Keywords

POS system, human-centered design, usability, user interface, prototype, UI design, UI design guidelines

1. Introduction

Food supermarkets and convenience stores have recently been providing an increasing range of goods and services closely attached to the daily lives of consumers and are also becoming an indispensable part of society as a base for measures against disasters. The businesses running such stores are now required to manage them more efficiently by providing high added value in the rapidly changing environment affected by the fluctuating economy and consumers' minds.

As part of this trend, systems such as POS cash registers, which are handled by many workers including part-timers, are required to implement visibility and legibility to enable users to instantly determine the action to be taken next. POS systems have not only a requirement for high quality but also an increasing requirement for greater ease of use. In this environment, NEC decided to apply Human-Centered Design to POS systems so that we can provide our customers with competitively advantageous systems.

2. Understanding of Usage Situations and Identification of Users

2.1 Identification of Operation Characteristics and Determination of Target Users

The first action we undertook was fieldwork involving customers in actual stores, in order to understand the characteristics of the target operations in cooperation with personnel from planning and sales departments as well as with the participation of usability specialists. In this fieldwork we identified the problems with the current systems, the characteristics of operations in the field, the concerns of users during use and other points noticed in observation. As part of the identification of operation characteristics, we identified what kind of user uses each function of the POS system, with what frequency, and compiled the results in a table like that shown in **Table 1**.

After the identification of operation characteristics, we examined the layout of the user interface (UI) schematic by taking into consideration the properties of target users and operating environments. This examination included coloring, texture and control elements such as buttons. We then developed some draft plans for them (**Fig. 1**).

Table 1 Identification of operation characteristics.

User	Frequency	Concerns
Store employees, headquarters, buyers	XX times/day	Access should be facilitated because it is performed almost every day before store opening. Merchandise with wide price variations should be registered in advance.
Planning personnel	Depending on purpose	A plan should be established every season. Planning situations should be checked every month (for main purpose).
⋮	⋮	⋮

Fig. 1 Examination of UI image layout.

Table 2 Task breakdown.

| No.	Task	Function Used
1	Sales registration (normal processing)	Sales Registration
2	Preparation of cash registers for store opening	Change Reserve Registration
3	Liquor registration (merchandise that requires age check)	Last Transaction Cancellation
3	(for underage customers)	
4	An old barcode label attached in an incorrect position is read instead of a barcode with a markdown price.	Last Transaction Correction
5	A customer returns to the selling space to look for something during product registration.	Transaction Suspension, Suspension Call
6	A customer requests cancellation of the purchases of certain items after all products have been registered. (Executed using the Input Item Void button. Applicable when a barcode label is attached to the product.)	Input Item Void (keyboard)
6'	A customer requests cancellation of the purchases of certain items after all products have been registered. (Executed using the Correct button on the touchscreen panel. Applicable when no barcode label is attached to the product.)	Correction (touchscreen panel)
7	After the customer pays 1150 yen, he/she requests the cancellation of purchases of all items at the moment the 1000-yen bill is entered into the automatic change machine.	Chargeback
8	The customer settles payment by credit card.	Sales Registration (credit card)
9	The customer settles payment by non-cash and cash.	Sales Registration (non-cash)
10	In a transaction of 905 yen, the customer hands over a 1000-yen bill and the automatic change machine returns 95 yen change. At this moment, the customer hands over an additional 5-yen coin.	Change Recalculation
11	After the change and receipt are returned to the customer, the customer requests cancellation of the purchases of some goods.	Return (partial return)
12	A customer comes in with a receipt, saying "I bought two items but three are registered by mistake."	Return (partial return)
13	A customer comes in with a receipt, saying "An item of 1640 yen is registered as 1780 yen by mistake."	Return (price correction)
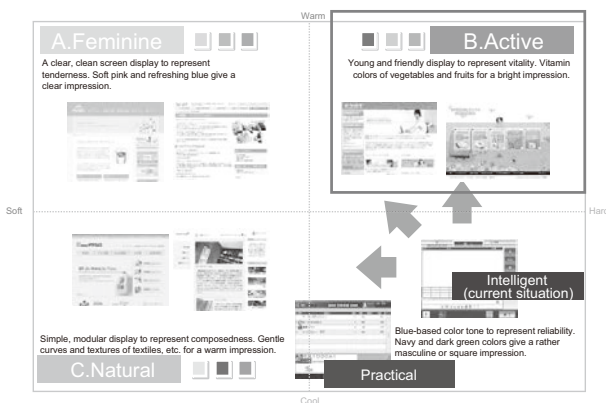
2.2 Organization of workflow

First, the usability specialists sorted more than twenty tasks assumed for current POS systems based on their current manuals, etc. (**Table 2**) The workflow was then compiled by checking the tasks of customers, checkers (persons in charge of registering the purchased goods by scanning them) and cashiers (persons in charge of accounting settlement at cash registers) in the stream of operations. In addition, the situations of current operations were confirmed through customer feedback to planning and sales personnel, for use in review of the tasks.

2.3 Usability Evaluation

Usability specialists conducted a usability evaluation to identify the usability-related problems and issues of the main functions of the current system (**Fig. 2**). A usability evaluation is a widely used technique with which usability specialists evaluate an interface based on known empirical rules to clarify problems related to usability. In addition, controllability issues were ranked in importance for use as data to start development. The main issues found in the usability evaluation were as follows:
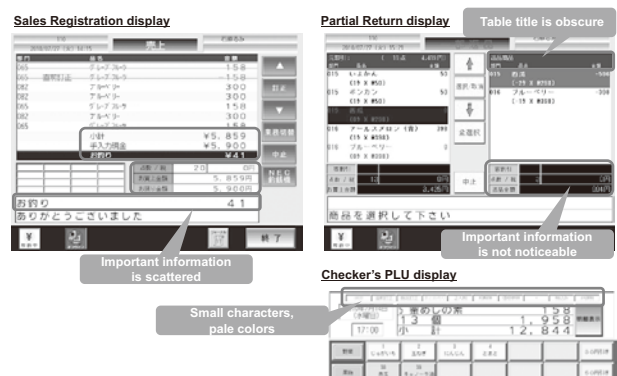

Fig. 2 Usability evaluation.

(1) The user cannot complete processing until he/she memorizes the operating procedure.
(2) Important information cannot be identified at a glance.
(3) Visibility is low because the font size and typeface are not suitable for the POS register.

We then arranged the identified problems and issues according to their priority.

3. Display Configuration Examination and Prototyping

3.1 Study of Display Transitions

Based on the workflow as examined from the viewpoint of the users, we then studied display transitions that can match the characteristics of the users (**Fig. 3**). Control operations should be configured so that user tasks can be achieved quickly and easily. The sequence and division of jobs should match the flow of operations so that users can use POS cash registers without being lost, getting confused or performing useless actions.

3.2 Wireframe Development

Next, we developed a Wireframe by incorporating improvements to the problems and issues identified in the usability evaluation. The Wireframe adopts a display configuration that considers the motions of the user's line of sight to improve controllability and reduce user fatigue. At this time we also studied a control policy that will become the common idea for various displays. Specific display images close to the actual implementation were developed at this stage for detailed examination in case they presented technical issues. The aspects of usability that we took special notice of during Wireframe development were as follows (**Fig. 4**):

(1) Screen layout that can guide the line of sight in a natural flow, considering the motions of eyes and hands (flow line from top left to bottom right of the screen)

(2) Layout of control buttons that can be easily understood to be "pushable" (able to be pushed)

(3) Grouping of associated information items to be displayed together in a single area

(4) Display of characters and buttons to be enhanced to a large size for easy comprehension

3.3 Prototyping

Based on the Wireframe, we repeated evaluations using actual mechanisms with the participation of planning and sales personnel, developers and usability specialists and eventually developed a prototype (**Fig. 5**). We enumerated the evaluation items in advance, including the colors and color pattern combinations, as well as whether "the control is easy to understand," "the interface fatigues the eyes," "the interface is easy and comfortable to view," "the displayed images match the store" and "the necessary information is included" from the viewpoint of the user. For visibility and controllability, enhanced evaluations were repeated in an ambient brightness and machinery layout similar to the actual store environment.

4. Compilation of UI Design Guidelines

Although the project reported herein covered only some of the control displays, we were able to compile a set of UI guidelines that will help future development personnel to design and implement other displays by deliberately considering their usability (**Fig. 6**). The compilation of consistent UI Design Guidelines will make it possible to provide a unified UI while avoiding regressive design.

5. Effects of the Application of Human-Centered Design

The present project adopted the Human-Centered Design process to make POS systems easy for users to view, understand and use. The main features of this system are as follows:
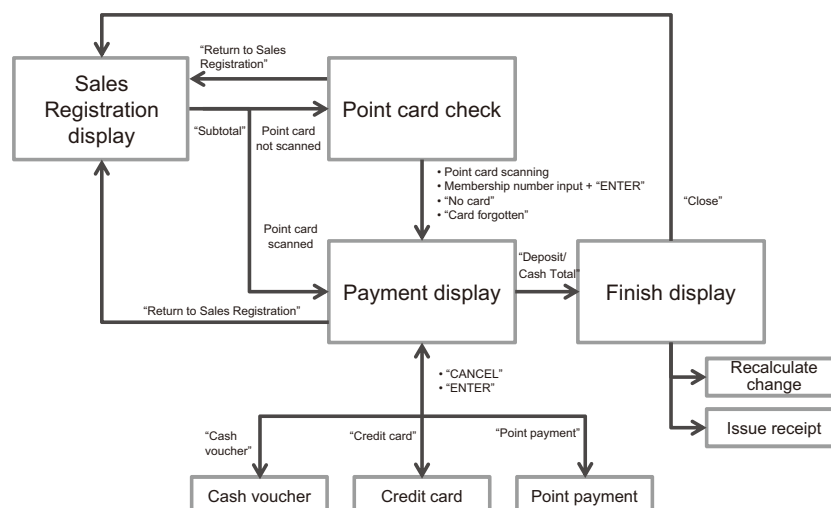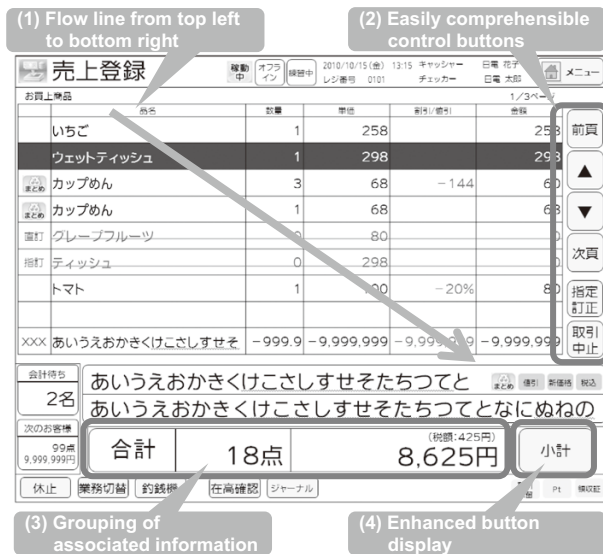

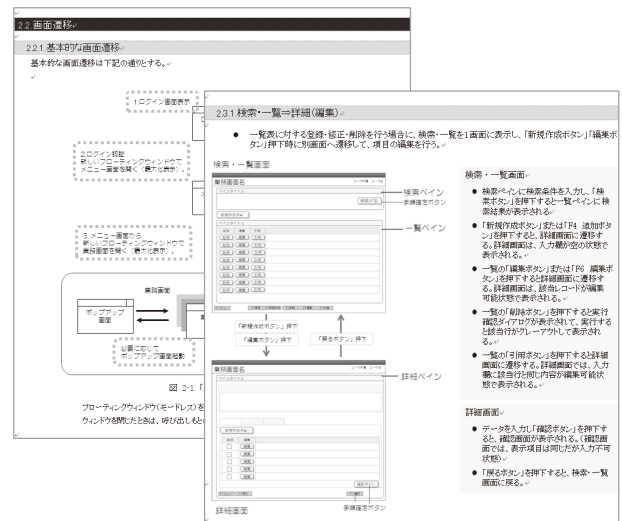Fig. 3 Study of display transitions.

Fig. 4 Wireframe development.

Fig. 5 Prototyping.

- Screen layout with full consideration of the motions of eyes and hands to improve controllability and reduce fatigue
- Selection of colors for panel buttons representing the products from 18 recommended color schemes to implement colors friendly to the user's eyes
- Adoption of the Universal Design Font and appropriate use of bold and regular characters for improved visibility and legibility
- Display configuration based on the principle of "one display per task" for a display design that enables an intuitive understanding of "what is being done now"
- Incorporation of product photos and pictures into panel buttons to facilitate intuitive control operations
- Resizable buttons to enable display layout according to job priority
- Selection of basic color tone from the three colors of green, orange/amber and blue to implement displays

Fig. 6 UI Design Guidelines.

matching the properties of each store

6. Conclusion

We succeeded in developing a POS system that is "easy to use without hesitation or mistake" for cash register users, who gave us feedback like the following:

- Operation is possible with an intuitive understanding of what to do next.
- The color tone and increased character size are easy to view and cause reduced eye fatigue.
- In the case of a register error, the error clearance procedure is displayed on the screen so that it is possible to continue working without a problem.
- Smooth control operation is possible with very helpful features such as the display of pop-up messages soliciting confirmation, etc.

As seen in the above, system development based on Human-Centered Design makes products easier to use and capable of providing added value for customers. In the future, too, we will continue to actively promote the application of the Human-Centered Design process so that we can offer systems with higher customer satisfaction.

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