User-Centered Design Promotion Activities in NEC

KOHNO Izumi, KOBAYASHI Masayuki, IIDA Jun, FUJII Hiromi

Abstract

In order to develop products with innovation as well as superior accessibility and usability, NEC employs user-centered design (UCD) for our product designs and developments. Our Universal Design and Brand Strategy Office is promoting universal design (UD) and UCD (user-centered design) activities over the entire NEC Group from three viewpoints. These are "awareness and skill improvement" via employee training, "practical activities" that support the development department using UCD in their product development processes and "lateral deployment" that shares the experience and expertise acquired from case studies among the staffs of the entire NEC Group. This paper introduces the details of our activities referred to above and discusses the results.

Keywords

universal design, accessibility, usability, innovation, user-centered design

1. Introduction

In order to achieve the NEC Group Vision, "to realize an information society friendly to humans and the earth," it is important to construct information systems and services so that everyone can use them without difficulty or error. At the same time, it is also important that users can gain new experience or an enhanced sense of values via these systems or services. We are promoting activities to materialize our vision by setting the following three topics as the main elements of NEC's universal design: "accessibility" that provides our products and services to diverse people from the elderly to the disabled, "usability" that provides products and services that feature ease of use, and "innovation" thereby providing products and services that can offer an attractiveness and a new sense of values. We employ user-centered design (UCD) to our products design and development in order to offer products and services with innovation as well as superior accessibility and usability.

Our Universal Design and Brand Strategy Office promotes smooth employment of universal design (UD) and UCD in each department by disseminating these concepts and their methods of application. We are promoting the activities from three viewpoints: "awareness and skill improvements" via staff training, "practical activities" that support the development department using UCD in their products development processes and "lateral deployment" to share the experience and expertise acquired from various case studies among the staff of the entire NEC Group.

2. Employee training

Employee training of UD and UCD aims to heighten the staff awareness of UD and UCD issues and to improve the relevant practical skills of the staff in charge of product design and development. In order to achieve these aims, text books are prepared and in-house seminars and web-based e-learning courses are provided. At the same time, staff can download these text books as well as other useful information from our departmental web site in NEC intranet so that they may study by themselves. The details of the types of training styles are described below.

2.1 Details of Training Courses

Essentially, two types of text books are prepared, one is for a beginners' course and the other is for a practical course. The one for the beginners' course contains basic knowledge about universal design and the one for the practical course contains further knowledge and is classified into three subjects: "accessibility," "usability" and "innovation." The practical courses are mainly for staff in charge of product design and development. The text books for the practical course employ a

Table 1 Education details to achieve UCD.

	UCD activity processes			
	Understand and specify the context of use	Specify the user requirements	Produce design solutions to meet user requirements	Evaluate the designs against requirements
Accessibility [Required activities]	- Understanding characteristics of the various users - Understanding usage environments of the various users	- Targeting a variety of users - Setting conformity to the guideline - Setting goals for "accessibility"	- Design considerations targeting a variety of users	- Accessibility evaluation (conformance assessments for a variety of users)
[Representative methods]	- Interviews - Observations - Quasi experience tools	- Guidelines	- Prototypes - Guidelines - Evaluation tools	- Check lists - Quasi experience tools - Evaluation tools - User tests
Usability [Required activities]	- Understanding human characteristics, especially cognitive and physical abilities - Understanding the characteristics of the targeted users - Setting usage conditions	- Targeting specific users - Setting goals for usability (effectiveness, efficiency and satisfaction)	- Ease-of-use design with issues eliminated	- Usability evaluation (effectiveness, efficiency and satisfaction)
[Representative methods]	- Questionnaires - Interviews - Observations	- Persona - Scenarios	- Prototypes - Guidelines	- Check lists - Walkthrough methods - Heuristic evaluations - User tests
Innovation [Required activities]	- Understanding essential values held by target users - Understanding emotional characteristics	- Targeting specific users - Setting goals for innovation	- Attractive designs	- Experience evaluations (evaluation of innovation and attractiveness)
[Representative methods]	- Interviews - Observations - Essential values extraction methods	- Persona - Constructing scenarios	- Techniques of conceptual expression - Prototypes - Acting out	- Scenario evaluations

consistent format in defining the aims and needs of the three subjects, providing case studies of NEC and other companies, and also in describing the requisite methods for practical activities. These methods consist of the essential processes for achieving UCD; "Collecting and Understanding User Information," "Clarifying the Goal," "Solving Issues of the Design Work" and "User Evaluations." Some representative methods are also provided to satisfy the requirements of each process. **Table 1** shows the requirements and the relevant representative methods designed to achieve "accessibility," "usability" and "innovation."

In order to achieve "accessibility," "usability" and "innovation," it is necessary to focus different processes, requirements and methods for each subject. To help staff learn the related skills quickly, detailed explanations are given to the key points in the text books. Short duration workshops are also arranged to teach representative methods.

In studying "accessibility," it is important to understand the characteristics of a variety of users including the elderly and disabled, etc. For this purpose, staff use color simulation goggles, etc. that help them to understand usage conditions and the environments of the targeted users.

In studying "usability," it is important to understand the usage conditions of the users and iterative evaluations and modifications are applied in order to improve usability for the targeted users. For this purpose, staff are taught the technique of interviews conducted directly with users to extract information regarding user conditions and needs. A walkthrough method used by product and services developers to simulate user actions is also used.

In studying "innovation," it is important to understand the real needs of the target users. Staff learn observation methods to extract the potential needs of users that the users themselves are sometimes unaware of. Besides proposing attractive ideas and solutions, it is important to visualize them and to examine their effectiveness. For this purpose, staff are taught

techniques of conceptual expression and of creating prototypes.

2.2 Types of Training

The beginners' course started on the web site in 2008 for the entire staff of NEC. A total of 33,000 staff including NEC and some of NEC Group companies attended this course.

The practical courses are held in the form of in-house group seminars or seminars for the business departments involved in development projects. Approximately 40 staff attended these seminars in FY2008, 160 in FY2009 and 60 in FY2010. Besides giving encouragement to attend these seminars, we recommend that staff study by themselves by downloading text books from the web site. The number of accesses to these text books on the web site is 200 to 800 per month on average. However, it reaches 3,000 accesses in a month that any related seminar is held. This shows that staff awareness to UD and UCD is quite high.

3. Applications for Product Development Sites

3.1 Aims and Details of Pilot Projects

Various pilot projects are conducted to promote use of UCD process at the actual product development sites. The main aims of these pilot projects are 1) to strengthen development skills of business departments by acquiring UCD methodologies and 2) to improve attractiveness and quality of our products by accumulating in-house case studies that employ UCD methodologies.

Pilot projects are selected among various departments of the NEC Group including hardware, software, and various development phases such as product planning, actual developments, etc. so that UCD processes can be examined in various product types and development stages. This procedure is followed because such pilot projects are expected to accumulate practical results via case studies and to spread these results to various business domains of NEC. Typical application projects are shown in **Table 2** .

Specialists in UCD activities are participating in these pilot projects in order to provide appropriate advice at various development stages and to help the development departments adopt an appropriate method.

In the projector development case study, for example, some types of personas were created as projector users, and on-site observations were carried out at the schools, etc. In the mobile phone development case study, paper prototypes were prepared to carry out iterative hypothesis testing, and dynamic mockups were then produced to evaluate the design in detail. In the server operation/management utility software

Table 2 Pilot projects employing UCD (User-centered design).

Project name	Purpose	Applied methods	Results of UCD employment	
			Strengthening of the product development capability	Improvements in product attractiveness and quality
Projector	- Design/Development process innovation and new product development	- User observation - Needs analysis - Persona/scenario preparation - Concept preparation	- Improvement of product design process including interviewing and presentation methods	- Design based on the results of observations - Awarded the prize of a Hardware magazine Gold Award
Mobile phone	- Usability improvement of a slim mobile phone	- Paper prototypes - Dynamic mockups - User evaluations	- Sharing evaluation results and methods	- Reflection of evaluation results in products
Flight Information System	- Design development employing UD conforming to the Airport concept	- Low fidelity prototypes - 3D prototypes - "Accessibility" evaluations	- Efficient project progress thanks to specialists support	-Information boards considering visibility and understandability
Server operation and management utility software	- Improved operability of current software to reduce operation/ management costs	- Heuristic evaluations - User interviews - User interface prototypes and evaluations	- Improved development process such as user interface evaluation at an early development stage	- Solving conventional UI issues - Proposal of UI with intuitive operability
Virtual PC management software	- UI development for new software focusing on the efficiency of business operations	- User interviews - User interface prototypes and evaluations	- Efficient development with UI parts provision	- UI development to meet the needs of each target user

case study, display screens prototypes using wireframes and animations were made to conduct user evaluations for solving issues at an early stage of the project process.

3.2 Results of Pilot Projects

Interviews with related staff were carried out half to one year after the pilot projects were completed and it was found that the following results were achieved by employing UCD concepts.

(1) Products development capabilities

- Support by specialists contributed to the smooth progress of projects. Also, thanks to the provision of user interface (UI) modules, development efficiency improved and development period of time was reduced.
- Some changes occurred in the design and development processes. For example, new features were always explained with scenes of use, and user interface (UI) designs were always checked at early stages of the development process.

(2) Attractiveness and quality of products

- By providing user evaluations at the prototype stage, some factors that did not match our hypothesis were found at an early stage of the product design process. This made it possible to develop products that meet more user needs.
- Visibility and readability as well as operability of several products have been improved.

4. Lateral Deployment of Results of Case Studies

4.1 Aims and Viewpoints of Case Study Preparation

By promoting UCD employment activities in the NEC Group, we accumulate case studies of product developments featuring UCD concepts and then pass on the results acquired from these case studies to our staff. We aim to develop the lateral deployment system to share these results and the related expertise among the staff of the entire NEC Group. The results of case studies were reported based on interviews with designers and staff in charge of the developments. These were described from the viewpoints of the following three subjects: 1) product features including points to be considered in achieving universal design, 2) development processes and factors that lead the project to success, and 3) effects of UCD.

When introducing UCD methodology, it is necessary to consider how to explain the effects depending on the role of the department. For example, in the case of sales department, it is important to show how much benefit the customer will have due to the implementation of UCD. Also, in the case of development department, it is required to indicate expected benefits of them such as optimization of development efficiency, etc. Therefore, in the section "3) effects of UCD," the benefits are described from two separate standpoints; the benefits of customers (value to be offered), and those of NEC. The benefits of customers are described as they correspond to which of the following categories; (1) accessibility, (2) usability, (3) innovation, or (4) contribution to TCO (total cost of ownership) reduction for customers. Also, the benefits of NEC are described in the same way; (1) contribution to receiving orders, (2) appropriate way of proposing plans, (3) improvement of development efficiency, (4) improvement of maintenance efficiency, or (5) enhancement of the brand value.

4.2 The Ways to Share the Case Studies over the NEC Group

The case study reports are uploaded to the intranet web site of the NEC Group to share them all over the group staff. In addition, we are promoting to share the achieved results and exchange opinions among the development staff through holding in-house exhibition of case studies and seminars.

In 2010, an exhibition to explain case studies of the pilot projects referred to in section 3 was staged in order to share the results and the relevant development process information (**Photo**) among NEC staff. In this exhibition, panels explaining project details were exhibited and also interactive presentations were staged by the staff in charge of the development or by UCD specialists. In the presentation, following topics were explained: what was the catalyst for employing UCD to support projects, the advantages and disadvantages of UCD employment and customer reactions to the projects that employ UCD, etc. The exhibition was held over half a day only,

Photo Case studies exhibition.

however, approximately 150 staff attended. Such good case studies could give the development department with similar products or business environments a clue to introduce UCD methodology and reference information on the development process and methods of UCD.

5. Conclusion

In this paper, our Universal Design and Brand Strategy Office is promoting the implementation of UCD methodologies over the NEC Group by the combination of activities such as educational courses, support for practical activities and the lateral deployment of acquired results and information. What is required in the next step is to foster more staff closer to the product development so that they can acquire higher level of expertise and skills of UCD, and to develop our activities to introduce UCD methodology into the organizational efforts. To this end, we are studying various measures such as training course with more realistic workshop experience, provision of in-house certifications for relevant skills, development of training systems, and inclusion of UCD into the standardized development processes, etc.

Our Universal Design and Brand Strategy Office also sends out information about our efforts for introducing UCD methodology to achieve “accessibility,” “usability,” and “innovation” via NEC’s web site, pamphlets, and outside lectures, etc. These activities also contribute to building our brand image as the efforts to achieve our NEC Group Vision “to realize an information society friendly to humans and the earth.” We will do our best to promote our UD and UCD activities so that our reinforced brand image will provide momentum for our product developments.

Authors' Profiles

KOHNO Izumi
Manager
Universal Design and Brand Strategy Office
Marketing Division

KOBAYASHI Masayuki
Manager
Universal Design and Brand Strategy Office
Marketing Division

IIDA Jun
Manager
Universal Design and Brand Strategy Office
Marketing Division

FUJII Hiromi
Department Manager
Universal Design and Brand Strategy Office
Marketing Division

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Vol.6 No.2 User-Centered Design

Remarks for Special Issue on User-Centered Design
NEC Group's Approach to User-Centered Design (UCD)

◇ Papers for Special Issue

Basic activities supporting practical projects

User-Centered Design Promotion Activities in NEC
The Role of Design in UCD (User-Centered Design)
User-Centered Design in SI/Software Development
Development of Design Patterns for HI Design
Development of Accessibility-Related Tools and Their in-House Applications

Product development case studies/Accessibility

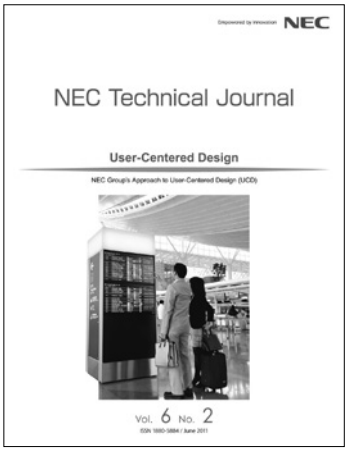
FIS (Flight Information System) Design at Haneda International Airport
Innovative ATM Development Pursues Usability and Environmental Performance from the Viewpoint of the Customer
Approach to UD Font (Universal Design Font) Development
User-Centered Design Activities of NEC Infrontia

Product development case studies/Usability

Development of Server Management Software "ESMPRO/Server Manager" Based on User-Centered Design
VoiceGraphy, Solution Supporting the Preparation of Minutes for Meetings Using Speech Recognition Technology, and Its UI Design
User-Centered Design Employed for the Smartphone "MEDIAS (N-04C)"
Human-Friendly UI Design for "Cloud Communicator"
User-Centered Design Activities for PCs

Product development case studies/Innovations

User-Centered Design for Projector Product Planning
Marketing of the "ShieldPRO" Rugged Notebook with User-Centered Design



Vol.6 No.2

July, 2011

Special Issue TOP