Development of Transfer Assist Robot Based on the User Needs

Mio Nakamura∗,∗∗∗, YoheiKume∗∗, Jun Suzurikawa∗, Shohei Tsukada∗∗,Hideo Kawakami∗∗, Kaoru Inoue∗∗∗, and Takenobu Inoue∗

∗Research Institute of National Rehabilitation Center for Persons with Disabilities
4-1 Namiki, Tokorozawa-city, Saitama, Japan
E-mail: nakamura-mio@rehab.go.jp
∗∗Panasonic Corporation
2-7 Matsuba-cho, Kadoma-city, Osaka, Japan
E-mail: kume.youhei@jp.panasonic.com
∗∗∗Graduate School of Human Health Science, Tokyo Metropolitan University
7-2-10 Higashiogu, Arakawa-ku, Tokyo, Japan

1. Introduction

New solutions to the problem of transfer assistance have been found in research and development in transfer assistance robots. One such transfer-assistance robot we are developing is the Roboticbed, which combines an electric bed and an electric wheelchair.

To develop practical technologies, this study examines the needs of targeted Roboticbed users, and extracts problems to be solved by Roboticbed technology.

2. Purpose

This study identifies user needs related to Roboticbed and extract problems based on the needs. This article includes a feasibility testing conducted for extracting needs for transfer and an experiment conducted for extracting problems based on the needs. We conducted evaluation by prototyping (a technique of making and evaluating a prototype in final form, making modifications to the prototype in a reflection of the evaluation results, and approaching the completion in step by step) .

3. Understanding of User Needs Related to Roboticbed

In order to understand the user needs related to Roboticbed, we have proposed and use two-phase feasibility testing, evaluation by rehabilitation professionals and evaluation by potential users. Participants were five rehabilitation professionals and six potential

users. Based on these evaluation results, professional evaluation indicated that users needed Roboticbed independence. Evaluation indicated the need for independent transfer alone or with minimum assistance, thus meeting our two concepts of independent user transfer and reduced assistance by caregivers.

4. Roboticbed Target Users and Proposed Lifestyles

We eventually targeted a man interested in using Roboticbed and his caregiver, and proposed daily use based on a scenario-based design.

・Scenario using Roboticbed

On days the wife goes out, she pulls a comforter over him and moves him to the wheelchair. Things that he wants to do in bed such as watching TV are done in the bed of Roboticbed. Things that he wants to do seated including checking email and eating are done. Even while his wife is out, he can get up as he wants. If his seated posture is poor, he adjusts it using tilting or reclining. If his wife forgets to prepare something, he can solve some of the problems himself.

After waking, having clothes changed, and moving from the center of the bed to the wheelchair, the man gets up by himself. While his wife is preparing a meal, he gets up and goes to the table to eat. He goes to the washroom to shave or brush his teeth on his own. Since activities in a fixed seated position increase, such as using his PC and watching TV, his wife does not need to prepare things in bed, thereby reducing the amount of assistance she provides.

In this way, we created the scenario below assuming Roboticbed is introduced in the life situation described.

5. Experimental Methods

To reduce caregiver burden and enable easy user transfer, we conducted experiments with transfer task performance time and the amount of burden. Participants in this experiment were five target users and their caregivers from among those extracted through professionals' evaluation in the feasibility study. Experiments measured transfer time between bed and wheelchair and questions about the amount of transfer burden (11-score rating scale). Activities using Roboticbed were superior to those using a transfer hoist in safety and minimizing time and effort caused by not hoisting and transfer by users whenever desired, so Roboticbed was effectively used by persons with severe disabilities and caregivers who must use a transfer hoist requiring a great amount of assistance.

In burden transfer results, caregivers noted that the burden was lighter with

Roboticbed.

The results of transferring time, some 30% to 50% of Roboticbed transfer time was accounted for by moving from the center of the bed to the right side, i.e., to the wheelchair. Furthermore, in seating in the separate wheelchair, persons with severe disabilities took more time. In the results of the experiment, it is needed to support independence in transfer of persons with severe disabilities, we must improve transfer, e.g., by sliding, onto the bed itself and the operation interface and improve wheelchair seating.

6. Conclusions

The purpose of this study has been to clarify user needs related to the Roboticbed and to develop technology based on it. We have extracted user needs based on feasibility testing and problems extraction in evaluation testing. Results have indicated that users, i.e., the elderly, those with disabilities and caregivers, have needs for both independent of transfer and reducing assistance related to Roboticbed. We have created and proposed scenarios for using the Roboticbed targeting one user for whom this Roboticbed concept was suitable. Based on this proposal, we have extracted problems based on user function and lifestyle such as improving the way in which a user slides onto the bed, improvement in operation interface, and improvement in wheelchair seating. Needs based evaluation has turned out to be useful for clearly specifying a design guide on user needs.