Development of flexible Text Input Device Based on Image Processing for Each Level of Disability Person

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Abstract: This research aims to develop a flexible input text device for physically disabled person using image processing. In proposed method we use a camera to detect the disabled person arm and hand movements via image processing technics, in order to identify these movements with exact disabled person intention on what he/she wants to convey. When the intention is detected, the disabled person can then input his/her intention or thought data through the device. The input method can be changed according to the user's disability level and is expected to have a positive impact for the rehabilitation of the user.

Keywords: Rehabilitation, Disability, Image processing, Input

I. INTRODUCTION

In Japan in order to deal with the aging population that is increased rapidly, the number of the caregivers is expected to reach 2.43 million by 2025 and 2.8 million by 2045, compared to the current number that is approximately 2.11 million [1]. However, even under the current situation, nursing care facilities are having difficulty recruiting new staffs [2]. This lack of caregiver's personnel is causing a negative impact not only on the quality of care but also on the deterioration of the working environment. To contribute to the caregivers working load, in this study, we propose the development of a flexible text input device that can be used by individual's person with physical disabilities. This input device is intended to detect arm and hand movements that show the physical disability person intention or what he/she wants to convey to the caregiver through using image so that an input user interface can be provided according to the disability level. This input device is set to be flexible. By changing the input method according to the disability level of each disabled person, the device can be used by many physically disabled persons, providing effective rehabilitation tailored to the user and reducing the burden on caregivers.

II. BACKGROUND

Based on the long-term care insurance business survey

plan released by the Ministry of Health, Labor and Welfare in July 2021, It was forecasted that by the year 2025, 2.33 million of care workers or caregivers will be needed and 2.8 million by year2045 is necessary. Compared to the current number of them that is approximately 2.11 million [1]. Compared to the current number of nursing care workers, this number must be 1.1 times by 2025 and 1.3 times by 2040, in order to deal with the Japan aging society.
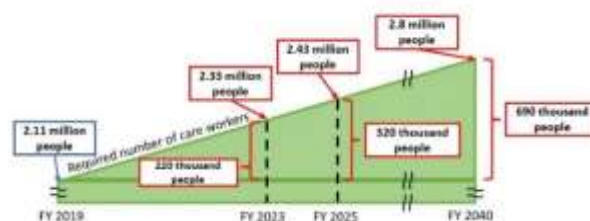

Fig.1 Number of Nursing Care Workers Needed Based on the Long-Term Care Insurance Business Plan

However, according to a survey done by the Center for Long-Term Care Work Stability, nearly 70% of long-term care facilities say that they are experiencing a shortage of staff, and 90% of these facilities say that it is difficult to hire a new caregiver. [2] This indicates that the nursing care industry is in a difficult due to ongoing labor shortage and a need for a significant number of additional workers in the future including the

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way for in recruiting new staff. The shortage of personnel also leads to an increase workload per caregiver, which in turn leads to a decline in the overall quality of care and a worsening of the working environment.
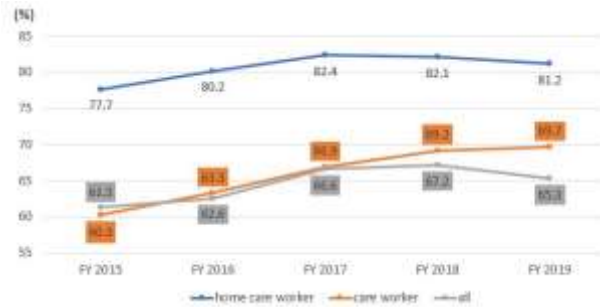

Fig.2 Shortage of employees engaged in long-term care services

III. PREVIOUS WORK

In a previous study done by Osato, Goto, Takegami et al. of Yokohama National University and Takasaki University of Commerce had developed a "text input interface for the severely handicapped using image processing." In this study, they created a device that detects blinking eye movements using image processing to input text and studied how to reduce false input and establish an efficient input method by using image processing to discriminate voluntary and involuntary movements.

IV. OBJECTIVE AND METHODOLOGY

A. Objective

We believe that the method developed in the previous study is effective when it comes to a method that allows physically disabled individuals to perform input on their own. However, this application was designed only for severely disabled people who can only move their faces, such as patients with end-stage amyotrophic lateral sclerosis or patients who are totally paralyzed due to spinal cord injury and so on. But it can be also use for those with minor or gentle disabilities who can move parts of their bodies and whose range of motion can be increased through rehabilitation. However, the drawback of this application is that a person with minor disability who depend the most on this application will lose the opportunity for rehabilitation.

B. Methodology

Therefore, in this work we purpose to "develop an input device that can detect arm and hand movements by image processing," which allows individuals with mild/moderate physical disabilities to input data of their thought on their own and whose input method provides opportunities for rehabilitation of the physically disabled and to caregivers or nurse the opportunity to better take care of those in need

This input device uses arm and hand movements as the input method, and the input site and movements can be set according to the disability level of each physically disabled person. By doing so, the system can be used by more physically disability persons, and since it requires movements tailored to each physically handicapped person, it can provide effective individual rehabilitation and consequently reduce the burden on the caregivers. Fig.3 shows the overview of the proposes system.
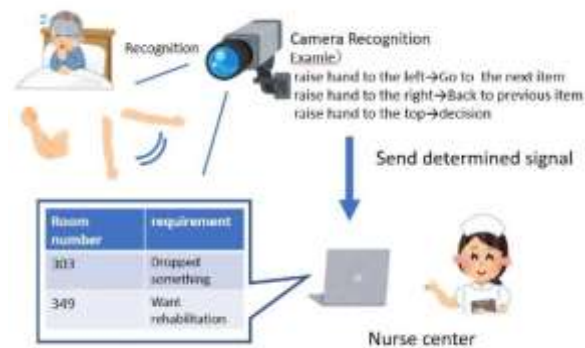

Fig.3 Overview of the fexible text input system

The camera recognizes the movements of a physically disabled person, such as bending his/her arm or hand in four directions. Based on the intention movements, the system determines the requirements for the nurse call, such as raising the hand to the left to go to the next item or raising the hand up to make a decision. These requirements including details information data that is sent to the nurse center computer monitoring the patient's situation. This allows the nurse center
That centrally manages the nurse call room and requirements so, to respond to the urgency and important calls on a priority basis. To grasp requirements in advance and prepare in advance will eventually save lives.

V. EXPECTED RESULTS

By developing a motion recognition system for the physically disabled in this study, input and rehabilitation can be performed simultaneously according to the injury level of each physically disabled person. In addition, the system is expected to reduce the burden on caregivers by allowing them to perform rehabilitation on their own and communicate their requirements to the nurse center without having to move.

In addition, by using this system to collect data and further improve the accuracy of camera recognition, it can be used to transmit other signals, which is expected to expand the range of activities and improve the effectiveness of rehabilitation for physically disabled persons.

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