An Assistive to Assist Physically Disadvantaged Persons to Input English Words

Yang Chih-Lung, and Wang Tzu-Ying, *MingDao University, Taiwan*

***Abstract*—Because of their disabilities, people with disabilities are particularly vulnerable financially and emotionally. The Internet is a rich source of facts, discussion, entertainment, finance and community. It may bright up their lives. Yet, they are online at a lower percentage rate than those who without disabilities, because of not enough training, cost of equipment and the accessibility of web content. English is the most used language on the Internet. However, using keyboards might be difficult for them. At times, spelling English words is error prone. In this research, we propose an English words input method. It uses gamming joysticks as input apparatus to assist those disadvantaged people entering English words easily and correctly at low cost.**

I. INTRODUCTION

Physical disability can greatly affect one's quality of living, social life, and emotions. Socially, people with disabilities often feel lonely and isolated [1]. Financially, their income may reduce because of their functional limitations [2]. There are also substantial costs adapting to their limitations. Most individuals have virtually no financial reserves and extremely low earning. Many of them live near or under poverty line. Through using computers and the Internet, they may make friends with others and may have their social lives without leaving home. This could ease their feeling of loneliness. The Internet is a rich source of facts, discussion, fun and community. For many disabled people, the internet really changes their lives [3]. To have a job, computer support specialist, accountant and statistician list as the best jobs for people with disabilities [4]. People with disabilities can benefit a lot from using computers and the Internet. Yet, 27% of disabled adults had never used the internet, compared to 11% of non-disabled adults. They were not online because of lack of training, cost of equipment and the accessibility of web content [5]. English is the most used language, about 51.2%, of the websites use English [6]. In this research, we develop a computer assistive, which assists people with physical disabilities to enter English words. This computer assistive is low cost, easy to learn, and effective.

II. KEYBOARD ERRORS DUE MOTORDISABILITIES

Keyboard has been the major character input device for decades. To the persons with disabilities, Trewin [7] points out seven errors that often happen when they use keyboards.

1. Long keypress errors: unintentionally press a key for longer than the default key repeat delay.
2. Additional key errors: Activate a key adjacent to the intended key.
3. Missing key errors: The intended key is missing entirely.
4. Dropping errors: The subject fails to press two keys simultaneously (e.g. use of the Shift key).
5. Bounce errors: The subject unintentionally presses the intended key more than once.
6. Remote errors: A key not adjacent to any intended keys is pressed (e.g., the subject accidentally leans on a key).
7. Transposition errors: Typing is out of sequence.

III. METHOD

To solve error 1, 5, and 7, we remove the repeat function by recognizing an on then an off (Edge Trigger) as a key stroke. We also add a de-bouncing filter. To solve error 2 and 6, we reduce the number of keys and arrange the keys close to one another but distinctive. Using a game joystick fulfills this requirement. To solve error 4, we use lowercase letters only. After the word is complete, we use another command to capitalize the first or all letters. Error 3 relates with the user's familiarity of the words. We provide a frequently used word bank [8]. When the user enters a word, the assistive software prompts the most frequently used words whose leading letters match the letters typed. In case if the user is not sure of certain letters, we provide a searching function that allows the user to skip several letters.

The input process works as in the following. Initially, the software displays as in Fig. 1. The 26 letters list according to their alphabetic order. We treat the second row not under the first one but to the right of the first one. Letter "m" with gray background is the candidate letter. If "m" is the desired one, then the user pulls the joystick down and selects the candidate. If the desired letter is to the left/right of "m", then the user pulls the joystick left/right. The candidate and the letters to its right/left disappear. The middle of the remaining letters becomes the new candidate letter. Users may repeat the above process to input letters.

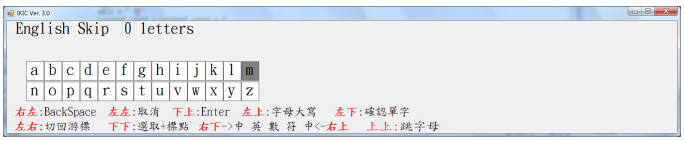

Fig. 1 Initial panel

Once the user enters a letter, it is queued within the quotes. In fig.2, the user enters "fr", and the frequently used words starting with "fr" show. If the desired word is in the above row, the user may pull the joystick "up" and start the word selecting process as in Fig. 3. The user selects the desired word the same way as selecting letters. To capitalize the word,

pull the joystick “up” as shown in Fig. 4. A “down” will enter the word to a document.

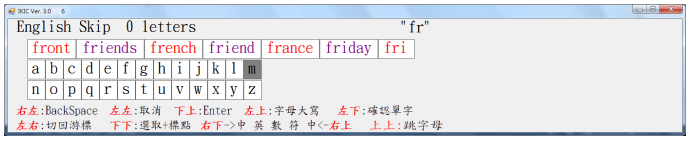

Fig. 2 Queued letters “fr” and the prompt words.

Fig.3 To select the prompt words.

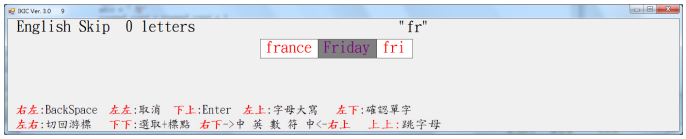

Fig. 4 Capitalize the first letter.

IV. EXPERIMENT

The fewer the letters enter to show the target words, the faster the entering process. We propose three ways to search target words. The first one enters the letter sequentially. The second one sequentially enters every other letters. The third one sequentially enters the letters but the vowels. We further select the most commonly used words of every length, from 5 to 18 letters, to compare the efficiency of the three methods. Fig. 5 shows by skipping every other letter is the most efficient one. Skipping vowels does not make the process more efficient than entering every letter one after another.

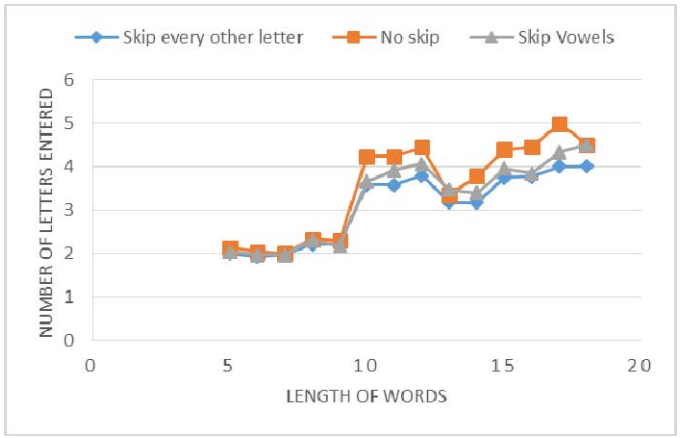

Fig. 5 Minimum letters required of the three methods.

English is not always phonetic and there are exceptions. That makes spelling even more difficult. We intend to verify if the users still can input the correct words by skipping several letters they are not sure. In the test, we allow the user to skip at most three letters between two consecutive input letters. Because our software prompts at most seven words, the word to find might not show after the first search. We add a command, a consecutive two push “right” which is similar to double-click, to make the software search the word bank again based on the same queued letters. We pick 10 “hard to spell” words in Table 1. By inputting the “most obvious letters” as the letters to match and let the software search for the desired word. As a result, the target word shows within two searches in most cases.

Table 1 Searching for “hard to spell” words.

Words to find	Letters to match	Number of search
catalogue	ctl	2
colleague	clg	3
Fahrenheit	frh	4
guaranteed	grt	2
heterogeneous	htg	2
immediately	imd	1
manual	mnl	1
millennium	mln	2
occurrence	ocr	1
religious	rlg	1

V. USER’S FEEDBACK

We invite a woman to use our assistive. She suffers severe cerebral palsy. Her hands deformed and has poor vision. Using keyboard is very difficult for her, because she has to search for the key among the sea of keys. She operates her motor wheelchair with joystick very well. Her comment is:

1. The software is easy to take on.
2. She can type with her head up and eyes on the screen.
3. Using joysticks is affordable and fun.
4. Although she has poor English ability, she thinks this assistive should benefits people with disabilities to input English words.

VI. REFERENCE

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