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Keyboard Tool in Cscw for Disabilities Word Processing Task Before and After Training and Adoption Processing System-KTDWPTBATAPS

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***Abstract*:-Previous research has shown that, without practice, users are slower using the foot than the hand to control input devices. This study compared the Performance (before and after practice) of users for disabilities training for below 10th, +2, Under Graduation, Post Graduation, Philosophy, Medicine, Psychology, P.hd and other job holders are operating a foot controlled Secondary input device(foot mouse) with the performance of users Operating a hand-controlled Secondary input device(hand mouse) to complete word processing tasks and Music(mixing of background sounds) requiring various amounts of keyboard and Secondary input device use. Both hands are disabled or accidently failed, but they are operated through foot mouse Before and After practiced word processing practice time. For all tasks, practiced improved performance and Save button for all users in word processor(Ms-Word, Note Pad, e-mail, word pad) with the foot mouse but not with the hand mouse. Mouth input will be played music and operating word processing task for disabilities(both hands and legs are failed). These findings suggest that, with enough practice, it may be efficient for users to use a foot input device for tasks that require keyboard input.**

***Keywords*:- input devices, Foot input, Hand input, Practice time, Skill acquisition, Word processing Task, Mouth input.**

I. INTRODUCTION

Prior to the Graphical User Interface(GUI), users handled cursor positioning and file/document navigation with no more than the keyboard and memorized commands. Although GUIs now allow for a much more efficient interaction with the computer environment overall, there are still costs associated with them in terms of receiving user commands. GUIs require a separate input device in addition to the keyboard, which becomes problematic as the secondary input device requires additional resources. The hand controlled mouse is most often used as the secondary input device for common computer activities. The hand mouse has been employed in this capacity to such a great extent for good reason. Using the hand, the user is able to quickly and accurately select On-Screen Keyboard for Disabilities(Left Hand, Right Hand , Left Leg, Right Leg, or Both legs) and otherwise manipulate the On-Screen environment. Mouth input device manipulate for Both hands and legs are disabled. Significant amounts of time and accuracy are lost when using the hand mouse because many of the resources required to use the secondary input device with the hand overlap with those that are already put to use during a typical interaction with the computer.(Typing on the keyboard). These performance decrements come from physically switching back and forth between devices(Card, Moran, & Newell, 1980) and mentally preparing to execute the physical actions after attention has been switched from one task to the other(Monsell,2003). |However, there is a possibility that this lost time could be recouped if there was a way to prevent those resources required by the devices from overlapping(Wickens, 2002).

We propose that performance might be improved by using a foot mouse as a secondary input device. In a direct comparison with a foot-controlled device, a hand –controlled mouse was used to more quickly and accurately select graphical On-Screen objects. However, these findings do not necessarily prove that a hand-controlled mouse is the best secondary input device, as there are disadvantages to its use that must also be considered. After all, when determining the efficiency of a system(Human Computer System-HCI) responsible for carrying out a complex or multistep task, it is important to evaluate the system as a whole. The issue underlying the hand mouse largely overlap the resources used in operating the keyboard. In particular , the dominant hand is used for controlling both the hand mouse and half the keyboard. This introduces an immediate time cost due simply to the time lost by moving than between the devices. This is called the homing time, which Card et al.(1980) determine to average 0.4seconds when moving the hand from the mouse to the keyboard or vice versa. Evidence has also been found for time costs resulting from the overlap of the multiple intentional resources required for various tasksandswitchingattentionfrom one task to another and it is conceivable that these costs are increased when the same effector is used for the two tasks. Another consequence of hand mouse use is increased musculoskeletal injuries. For example, the awkard angles forced on the user by the standard keyboard and hand mouse have been identified as risk factors for carpal tunnel syndrome. If an alternative secondary input device, such as a foot mouse can be used effectively, then it would create a human-computer system that is both efficient and safe for the human involved.

All previous research has shown that foot-controlled input device perform worse than hand-controlled devices. However , upon further review it is apparent that all past experiments in one way or another biased better performance for the hand-controlled input devices. The largest recurring issue was that participants were less experienced with using the foot for this type of input. It is known that practice results in changes in coordination of motor skills and that performance on more difficult tasks benefit from practice than easier tasks. Thus, it is important to attempt to equate practice effects .Yet, in the Worst case, past comparisons were made between new operator performance on the foot mouse and experienced operator performance on the hand mouse. Other issued contributing to biased comparisons in the previous studies were that commercially available foot-specific input device were never used and tasks requiring keyboard and secondary input device would not performed.

The current study examined whether freeing the hands from controlling a secondary input device during multistep word-processing tasks requiring keyboard use would lead to better performance on these tasks than when the hands are used to control both the keyboard and secondary input device is warranted, the present research deviated from the methodology of previous research on foot-controlled input devices in several aspects. First, this experiment used multi-step word-processing tasks that required the user to manipulate both the keyboard and hand mouse. Using multistep word-processing tasks obviates the need for adding on estimation of device switching time to hand-controlled input device performance times. The goal is to provide a more realistic measurement of task completion times and to allow experimental findings regarding the operation of a secondary input device by the foot to be generalized to an application in which it would most likely be used. Second, a foot-specific input device was used for foot input. Third , a hand specific input device that was not over practiced like the hand mouse was used for hand input. Finally, practice was given with the input devices.

II. METHOD

1) Design:

This experiment involved a three –way[2(practiced device: foot mouse or hand trackball or mouth stick) X 2(operated device: foot mouse or hand trackball) X 2(test session: pre-practice or post –practice)] mixed design. Practiced device was a between-subject manipulations. It should be noted that, although participants were tested on test days(first and last day sessions experiments) using both the secondary input devices , they received practice with only one device on the practice sessions seen Fig.1. This made it possible for participants to act as a control group for the device on which they did not practice to determine whether there were differences between task performances on the test taken on Session 1 and Session 10 that were not attribute to practice with the secondary input device(e.g. differences due to tasks repetition).

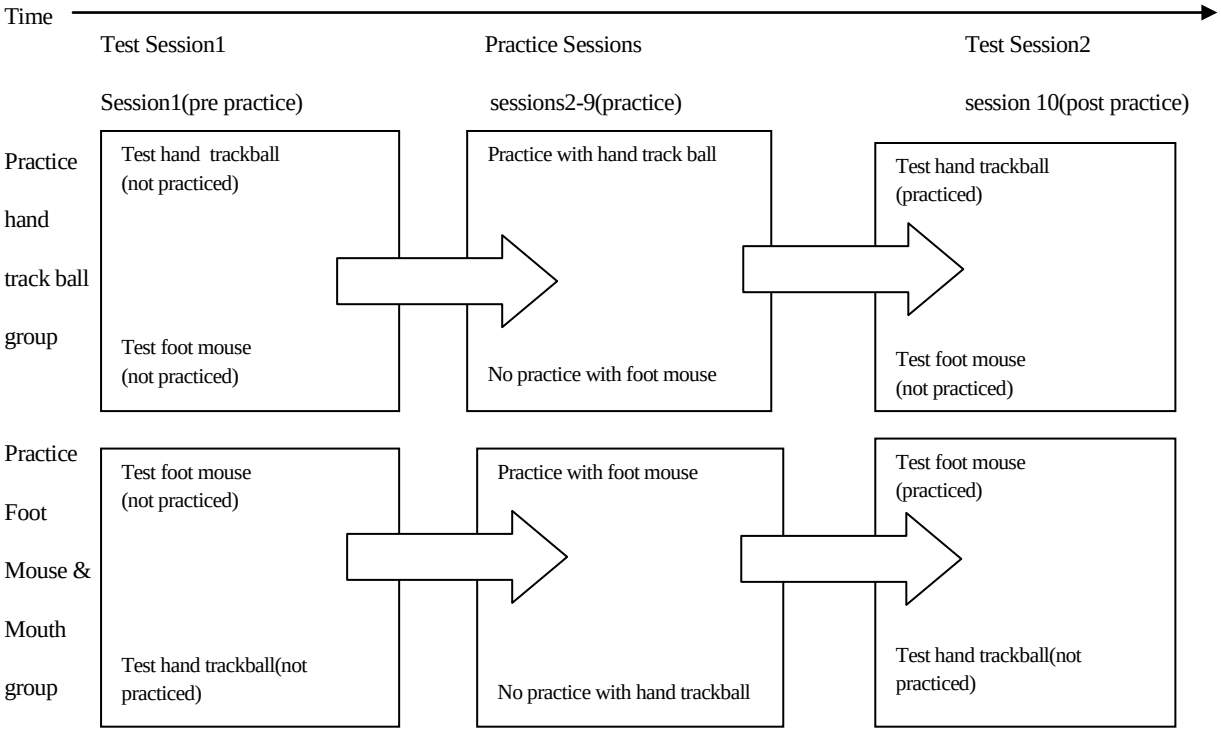

Fig.1 Experiment schedule flow chart depicting what participants from the two device groups did on each of the 1

Participants (Disability Candidates)were recruited from the personal in daily life in institutions, organizations, trusts. Participants ranged from 17 to 32 years of age(Mean= 4.4 variance=1.37 Standard Deviation=1.17). All participants reported that they had normal vision, were right handed and footed, and had full use of hands , feet and mouth .Most

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participants reported being relatively experienced with computers and familiar with Windows-based computer(only 3 participants spent less than 20 h a week using Windows- based computer and familiar with the Microsoft word, Microsoft notepad Word pad and Word processing program. Almost all participants also reported that they were very familiar with using the hand mouse, but not at all familiarity with the trackball was more varied, where roughly the same number of participants rated themselves as being "OK", "Not Very", and "Not at all" familiar with using a trackball at the beginning of the experiment, although the most common response given was "Not Very" it was easily understood seen in the table number is Table.1.

TABLE 1

FREQUENCY OF PARTICIPANTS FAMILIARITY RATINGS FOR HAND MOUSE, FOOT MOUSE AND MOUTH STICK BROKEN DOWN BY PRACTICED DEVICE.

Question	Practice Device	Very	Fairly	OK	Not Very	Not at all
Firstday Experiment Mouse	Hand-Hand	8				
	Left-Hand	3	2			
	Right-Hand	12				
	Foot-RH		10	3		
Mouthstick				1		
Lastday Experiment Mouse	Hand-Hand	20				
	Left-Hand	5	1			
	Right-Hand	24				
	Foot-RH	8	1	1		
Mouthstick		5	2	1		
Firstday Experiment Mouse	Hand-Hand	3				
	Left-Hand	1				
	Right-Hand	1				
	Foot-Foot		1	1	3	1
Mouthstick				1		
Lastday Experiment Mouse	Hand-Hand	4				
	Left-Hand	2	1			
	Right-Hand	2				
	Foot-Foot	4	1	1		
Mouthstick		1	1			

TABLE 2

MEAN COMPLETION TIME FOR THE FOOT MOUSE AND HAND MOUSE ON TASKS 1 AND2 AT TEST SESSIONS 1 AND 2 AND AVERAGE ACROSS TEST SESSIONS

Task test	Operated Device	Test Session 1	Test Session2	Average across Sessions
Task 1	FootMouse	6370	4350	5360(Total time in Sec)
		637	435	536 (Mean)
		.690	.250	0.47(Varience)
		60.75	40.43	54.09(SD)
	HandMouse	214	64	139(Total time in Sec)
		21.4	6.4	13.9(Mean)
		17.2	8.2	12.7(Varience)
		4.15	2.88	3.515(SD)
Task 2	FootMouse	642	162	402(Total time in Sec)
		64.2	16.2	40.2(Mean)
		154.4	2.4	78.4(Varience)
		12.425	1.549	6.987(SD)
	HandMouse	47	44	45.5(Total time in Sec)
		4.7	4.4	4.55(Mean)
		1.34	1.37	1.355(Varience)
		1.159	1.17	1.1645(SD)

3) Apparatus and materials

An input device designed specifically for the feet was used for foot input in this experiment instead of forcing the feet to adapt to a device designed for the hand. The NoHands mouse was chosen as the foot-controlled input device for the experiment because, when devices were reviewed for purchase, there were no other commercially available options for a foot-controlled secondary input device that had the same capabilities as a hand-controlled input device. Other available foot devices were essentially sets of switches to which functions could be assigned. In an attempt to balance participants experience with hand-controlled and foot-controlled secondary input devices, a Logi-tech Trackman Wheel trackball mouse or optical mouse was used as the secondary input device for the hand rather than the over practiced mouse.

Based on the task domains outlined by Karl, Pettey, and Schneiderman(1992), a word processing environment(word pad, e-mail editor, note pad) similar to Microsoft Word(Windows 7)

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was developed for the experiment. Visual C++ was used to develop the practice program for the practice sessions with the secondary input devices. The practice program involved the three types of activities(selecting buttons, highlighting text, and scrolling) that participants performed with the secondary input device during the word processing performance tasks, did not involve keyboard input. Visual C++ was also used to create the program that provided the workspace for the word processing performance test tasks and measured the practiced time during the tests. Both the practice trails and the word processing performance tests were run on a Pentium-4 based personal computer using a 19" color monitor. Text input was handled by a standard QWERTY keyboard, while the trackball, mouth stick and foot mouse handled command activation and direct manipulation activities.

The materials and task domain used to evaluate word-processing task performance were slightly modified from those of Karl et al(1992). Who designed four short word-processing tasks, requiring varying levels of textual input, for their experiments. The command activation is choosing a button and direct manipulation activities are scrolling and highlighting. Participants are used in practiced time with several options like font, color, arithmetic calculations and other modules are used through foot mouse or hand mouse or mouth stick for digital signature, draw different shapes in geometry, planning of route map in aero plane, train, power plant, play a music and ship or ship port. After using the secondary input device to select a portion of text, participants used the secondary input device again to select a formatting command from the appropriate button . This task was completed using only direct manipulation and command activation with the secondary input device and did not require the use of a keyboard. Some participants to type a short scientific formula $s=ut+1/2at^2$ and compute aircraft lift is specified by the equation $L=C(\alpha)S\rho V^2/2$, mean $S=x_1+ x_{2+} x_{3+} x_{4+} x_{5+} x_{6+} x_{7+}$ ---------- $+ x_n/n$ and standard deviation etc. To complete this task successfully there was a minimum ratio of 1:24 required keystrokes to 1 required for matting command. Participants were asked to type the formula left to right as they activated the necessary commands with the secondary input device and it is best compartable for typing text and calculating arithmetic calculations with out limited size of data(Calculator was taken only 12 bits to 16bits size of edit information). Some participants building programs such as C-Language, C++ Language, Java Language, Visual Programming, Web Technologies (HTML, Java Script, Applets), Oracle , SQL Commands through foot mouse and some participants are used hand mouse and keyboard on word processor. English alphabets a,b,c,…..z,A,B,C,…….Z ,digits 0,1,2,3..9 and Special Symbols @,$,#,~,…. etc. are easily used individual characters rather than combination of characters, Because, the practice time or typed paragraphs or lines of code(LOC) or programme or arithmetic calculations are very easy through this word processor. This word processor was used in aircraft, military, Disability Education Training(foot mouse-two hands are missing and mouth stick- Both hands and legs are missed), power plant, ship port and stock market exchange etc. It is using the copy (Ctrl+c) and Paste(Ctrl+v) keyboard accelerator commands while navigating the document by scrolling up and down. Without using keyboard, just right click on workspace and select any option like cut, copy, paste, undo and select all through foot mouse or hand mouse. To create a keyboard to secondary input device dynamic that was similar to the previous task, there was a minimum ratio of 1 required keystroke to 1 required direct manipulation with the secondary device. This task required both typing and direct manipulation activities. Participants use the secondary input device to drag the scroll bar in order to compare what was being copied to what was being typed because the paragraphs were on separate pages. The paragraphs were arranged so that if participants scrolled down to the correct spot on the page, they could see both the line that was being typed and the line that was being copied. As soon as the next line was begun, it was necessary to scroll down one line to see the text of the next line appear as it was being typed. Since it was not necessary to scroll down to continue typing, it was possible for participants to type without seeing the text appear on the screen as they typed it. If participants wanted to see every line as they typed it, the minimum keystroke to secondary input device activity ratio was 5.01 to 1. This task incorporated all three word processing components: typing, command activation and direct manipulation.

4) Procedure

Up on arrival, each participant was asked to read and sign consent form to participate in the research. Participants then completed a experimental questionnaire designed to gather information about their computer experience. They were then asked to sit infront of a computer monitor at a comfortable viewing distance. Participants were randomly assigned to groups such that half received practice with the foot mouse(Save button in Micro soft Word, note pad, word pad, e-mail editor, playing a mixing of background music's)and half received practice with the hand mouse. A flow chart presenting the sequence of practice and test sessions can be seen in Fig.1.

Some participants are used through hand controlled secondary input device first. This experiment, when the participants used the foot mouse, they were asked to read an information characters on correct body position for working with the device. Participants completed a block of practice trails to familiarize themselves with the device seen Fig.2.

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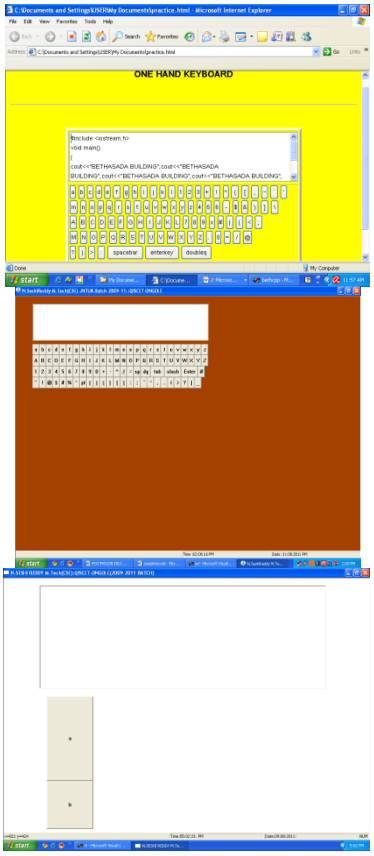

Fig.2 Disabilities Tools for word processing tasks.

Every paragraph or page of information of text/digits/arithmetic calculation/play a background music working total time was to complete entire task were recorded automatically by the Web programming or Visual C++ programming. So that , more than one page of text/ digits for adding text through scrolling in work space. The work space consists of unlimited size of memory for Text/ Digits and arithmetic calculations. After participants had performed 70 practice trails of this type, then completed the word processing tasks and their performance(Completion time was measured). Participants always worked through the tasks in order Task1 and Task2. Each task was explained to the participant just before the participant begun and any questions were answered. Participants took a 2-to-3 minutes break between tasks. Each part of Test session 1 less than an hour. When participants has finished all practice sessions, they returned for a post-practice test session using both input devices to work through all word processing tasks. The above word processor in Fig.2 are used in Mobile phones or Satellite communications for unlimited size of text for message passing with limited amount of time and also used in Disabilities Education and Training purpose.

5) Rationale for data analyses

For the practice session, a 2(device) x 10(practice block) mixed ANOVA was performed on the average practice trial completion time for each of the 10 blocks of trials participants worked through during the practice sessions. Device was the between-subjects factor, and practice block was the with in subjects factor. For the test sessions, separate 2(practice device: foot mouse or hand track ball)x2(operated device: foot mouse or hand track ball)x2(test session) mixed analyses of variance(ANOVA) were performed on task completion times for word processing task. Practiced device was the between-subjects factor and operated device and test session were within-subjects factors, Because this research involved measuring task completion time for separate tasks performed on separate occasions, a decision had to be made whether to analyze these tasks separately. The decision was made to run separate ANOVAs on each task was the same, the tasks themselves were very different from one another to determine whether they yielded different from one another in terms of type and quantity of component activities. Thus, it did not make sense to compare tasks directly to one another to determine whether they and quantity yielded different completion times. Large differences in completion time mean, variance and standard deviation tasks(seen in Table.2.) made task comparisons difficult.

3.RESULTS

1) practice trials

During practice trials, participants used only the secondary input device to complete direct manipulation and command activation relatively large improvements in hand trackball performance occurred only during the beginning of practice(seen in Fig.3).

2) keyboard with command activation and direct manipulation

Participants used the keyboard and the secondary input device to carry out the activities(typing, command activation, and direct manipulation of on-screen objects) necessary to write and format a paragraph. The results of the 2x2x2 mixed ANOVA on task completion times also showed a significant main effect for

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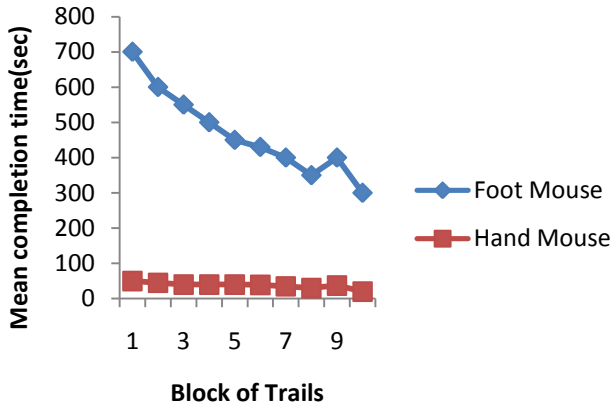

Fig.3 Mean practice trial completion time as a function of practice device and practice block.

device was found, F(1,9),ρ<0.001,such that relatively large improvements in performance were seen over the entire practice period with the foot mouse, while relatively large improvements in hand trackball performance occurred only during the beginning of practice(seen in Fig.3.)

operated device, F(1,9)=20.12,ρ<0.001, where participants were 230s faster with the hand trackball than with the foot mouse. There was also a significant main effect of test session. F(1,9)=39.20,ρ<0.001, such that participants were 176s faster at Test Session 2 than at Test Session1. Similar to the other three tasks, these effects were qualified by a significant practiced device x operated device x test session three way interaction(seen in Fig.4), F(1,9)=5.06,ρ=0.041, Follow-up analysis yielded a significant interaction of practiced device x test session for the foot mouse, F(1,9)=6.17,ρ=0.026, but not when the hand trackball was the operated device, F(1,9)<1.0. When participants operated the foot mouse and had practiced with the foot mouse, their completion times improved 318s from Test Session1 to 2 compared to the 49s benefits from Test Session1 to 2 when they operated the foot mouse and had practiced with the hand trackball.practice trial completion times. There was a significant main effect for device, F(1,9)=5.24,ρ<0.001,such that participants were faster with the hand trackball(M=12.37,SD=1.02) than with the foot mouse(M=31.23,SD=10.30). There was also a participants were generally faster on later blocks than earlier blocks. Occasionally a later block was slower than one or more previous blocks, but completion times on the whole trended downward. This is evidenced by the fact that the average trial time for the last practice block(M=19.20, SD=10.57) was faster than the average trial time for the middle practice block(M=154.4,SD=12.42), which was faster than the first practice block( ).A significant interaction of practice block x

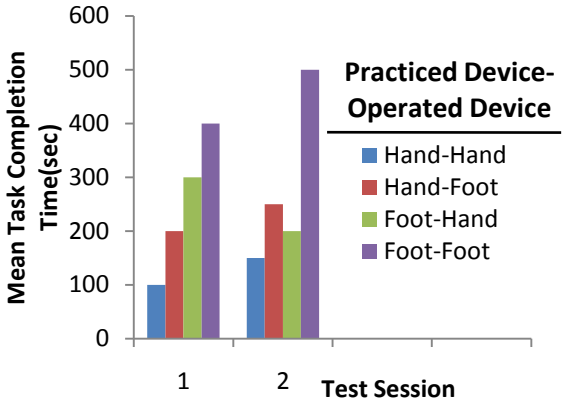

Fig.4 Mean Task Completion time as a function of practice device, operated device, and test session

3) Post-experiment questionnaire

Responses to a post-experiment questionnaire provided information about participants familiarity and comfort with using secondary devices. Although they did not use the hand mouse in the experiment, participants were also asked to rate their familiarity and comfort with the hand mouse for comparison purposes. Participant responses on their comfort using input devices are presented in Table 3 and responses on their familiarity with the devices are presented in Table 1.

IV. Discussion

1) summary of findings

With respect to performance on the practice trials, participants improved with both the hand trackball and the foot mouse. Also, with both devices greater improvements was seen at the beginning of practice than at later practice sessions. However,

participants showed greater improvements in the practice trials with the foot mouse than the hand trackball. These findings are consistent with the findings that come from the analysis of participants performance on the task performed before and after practice

2) Using Digital Signature

Disabilities i.e Signature of thumb impression of Orthopedically Handicapped/ Paralysis person/ Patient of required column(Railway Concession, Aircraft Concession and RTC concession)was filled through foot mouse (Both hands are missing) or mouth stick (Both hands and legs are missing).

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TABLE 3

FREQUENCY OF PARTICIPANTS FAMILIARITY RATINGS FOR HAND MOUSE, FOOT MOUSE AND MOUTH STICK BROKEN DOWN BY PRACTICED DEVICE.

Question	Practice Device	Very	Fairly	OK	Not Very	Not at all
Firstday Experiment Mouse	Hand-Hand	6			1	1
	Left-Hand	3		1	1	
	Right-Hand	10			1	1
	Foot-RH	7	2	1	2	1
Mouthstick				1		
Lastday Experiment Mouse	Hand-Hand	20				
	Left-Hand	6				
	Right-Hand	15	5	2	2	
	Foot-RH	5	2	2	1	
Mouthstick		5	1	1		1
Firstday Experiment Mouse	Hand-Hand			1	1	1
	Left-Hand				1	
	Right-Hand				1	
	Foot-Foot		1	3	1	1
Mouthstick				1		
Lastday Experiment Mouse	Hand-Hand				2	2
	Left-Hand				1	2
	Right-Hand				1	1
	Foot-Foot	3	1		1	1
Mouthstick		1	1			

software was built with Microsoft Visual C++. The signature was taken from manually through feet seen in Fig.5, The signature was taken from foot mouse through Microsoft Visual C++ Software seen Fig.6. Compare both figures Fig.5 and Fig.6 , Scanning cost was reduced through Fig.6 rather than Fig.5(Manual Signature.). Fig.7 is the required signature from adobe photo shop software then copy and pasted with the required position or portion

Fig.5 Manual Signature

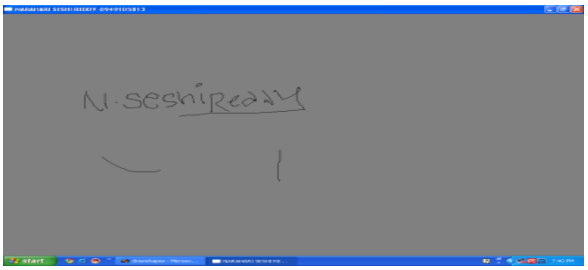

Fig.6 Foot Mouse Signature

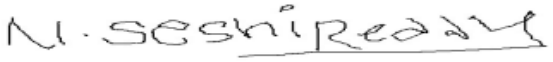

Fig.7 Desired Signature

3) Implications for design and future research

The results of the current research can be taken together to form a set of design recommendations for future foot-controlled input device design. Chief among the concerns uncovered by this research is the need for a design that is durable and provides reliable performance across uses. The foot mouse used in this experiment has issues in meeting standards, as it could not handle the demands of repetitive use as well as the hand trackball. The materials used in the construction of the foot mouse were such that they could become worn out fairly quickly. Perhaps the most interesting finding from the post-experiment questionnaire was that participants who had practiced the foot mouse indicated being comfortable with the device but not very familiar with the device of foot mouse for disabilities seen in Figures from Fig.5 to Fig.7 and Fig.2. The foot mouse design(CAD) will be convenient for manufacturing with comfortable for Disabilities or others. Use of the foot mouse in the office setting will also require that the office itself will be able to accommodate the placement of a foot mouse. This may involve the use of an adjustable chair or table to ensure that the optimal body position is maintained while operating the device. One benefit of using a foot mouse is that it should

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reduce strain placed on the wrist. Since good ergonomics include the use adjustable seats and tables, these factors may not be huge concerns for work environments that already adopt good human factors for computer supported cooperative work(CSCW). Additional research for Visual C++ program in google typed text in MS-Word or note pad or e-mail or word pad applications through keyboard and secondary input device hand mouse or foot mouse. The coming soon research design for word processing task will be shown in Fig.8.

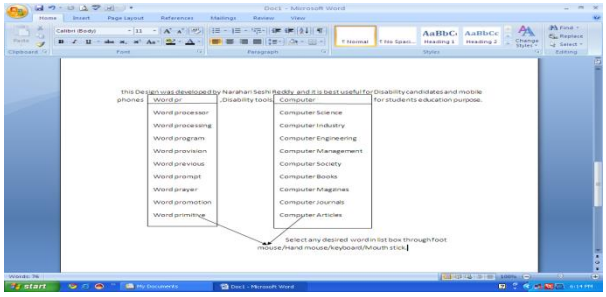

Fig.8 Coming Soon word processor(e.g Google search/ You tube/ face book search selection).

V.CONCLUSIONS

After practice with a secondary input device, performance was better on computing tasks when participants used a trackball than when they used a foot mouse exception a multistep word processing task, where there was no significant difference between performance with the foot mouse and the optical mouse or trackball. Now a days, most of the people are entertainment with music, audio and video games as well as movies and played music easily through foot mouse and every office foot mouse used for word processing task in the case of Save button. So coming days foot mouse operation was very easy for disability candidates(seen in Fig.8 for both hands are missing or legs and hands are missing-mouth stick) and efficiency with a foot operated device that would make it attractive to use as a secondary input device for word – processing activities.

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