Assistive tool for text entry for single handed users

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Abstract - This paper is an insight into investigation and research carried out to develop a prototype of an assistive tool for single handed users, limited muscle movements and muscle weakness, limited movement of arms, unable to use a part of the body e.g. hand due to result of a illness or simply because of old age. This assistive tool allows a single handed user to enter text using numeric keypad of a standard QWERTY keyboard. Research lead to development of an assistive tool which uses existing hardware and is user friendly, which can be used both by able and disable users. The primary users of this artifact are single handed.

I INTRODUCTION

Computers are becoming an integral part of our daily life. Everyone from children to old age people uses computers. It could be for office or school wok or it could be merely to use internet. Computers are being used by able and disabled which have resulted in risen of need to make computer more accessible.

Whatever the purpose of computer usage is, sending e-mails or real time conversation, surfing online information databases, make a report for head office or type an essay for English home work, these require some kind of data to be input to the system. E-mail consists of many letters typed by user so do the real time communication between users where small sentences typed by each user are exchanged over the communication line. From logging on to computer to accessing a specific website, user have to type URL address of the website or some keyword in search engine. A lot of typing is required to complete a report for head office or for an essay.

Disability can be described as a health-related inability or limitation on amount or kind of work that could be carried out [1]. There are many disabled people around us of whom some might not have a visible disability but a disability which cannot be seen. Statistics show that there are many disable people around us whether we are aware of them or not. According to Family resource survey 2002/03 there are about 10 million people in U.K with disabilities. According to Pew Internet and American life tracking survey march 2004 around 73% men and 72% women use computers. According Australian Bureau of Statistics 42 per cent of Australians own a home computer and 37 per cent use the Internet. According to survey carried out by home working solutions in February 2006 62% of people said to use computers at home or work in U.K. Statistic show that more than half the population of world use computer every day and text entry is one task common carried out by all those people. Currently, when computers are becoming an integral part of our daily life, there is a great need of assistive tools and technologies to be developed to help those people use computers without their disability causing any hindrance. This project will result in developing an assistive tool for text entry for single handed users.

Normal QWERTY keyboard may seem normal to most people but it poses a lot of difficulty for people with only one hand, postural limitation, muscle weakness, limited movement, and head injury resulting in hemiplegics (paralysis on one side only), Muscular Dystrophy or stroke. QWERTY layout keyboard are good for most people but they pose difficulties when used by people with physical impairments resulting in higher typing error rate, fatigue and inefficiency.

There are many hardware keyboards available, which are specially designed to be used with one hand. This soft keyboard is developed to eliminate the need of buying and carrying a special keyboard.

II PREVIOUS STUDIES

As assistive technologies is a vast field and can be classified in to different categories the research reported here only emphasises on text entry for single handed users. Research was focussed to find a method to allow this group of users to enter text in an effecient manner e.g with speed and minimum error rate without the need to buy special hardware keyboards or need of a touch screen to enter text using other soft keyboards. The standard numeric keypad of a QWERTY keyboard is used to enter text with either one hand or one finger. This keyboard can also be used with a touch screen or a pointing device like mouse. Different text entry techniques like chorded, multitap and consecutive were considered [2][3] and evaluated against speed of text entry and difficulty to learn. Although the QWERTY layout is entrenched

for standard keyboards, most of the on-screen keyboards are designed based on QWERTY layout. It is not a good user interface for people with physical impairments [4]. Special layout for the key was needed. Ambiguity arises when 26 characters needed to be mapped on 9 numeric keys [2] which needs to be resolved. Three alphabets were mapped on eight keys and two alphabets on 9th key. Mapping of an alphabet to key was initially done like "ABC" to "1" , "DEF" to "2" and so on but later testing showed this mapping scheme to be ineffective and tiring for participants. Most used alphabets in English are E, T, A, O, I, N, S, H and least frequent used letter include J,Z,Q,X.[5]. So these letters were needed to be mapped in such a fashion that arm and finger movements should be minimal to access the alphabets. Research revealed that every single handed user has their respective characteristics [6] and different needs for the size and colour of the text. So the user is allowed to change the font size and colour of the text in the beginning or anytime during the use of program. Buttons were used instead of menu to make it easier for the user to carry out common tasks like save, colour, font, help etc. [7]

Num2Text soft keyboard was developed with visual C#. It consists of the keys and text editing space where the typed numbers and words would appear (figure 1]. It provides the visual feedback to user e.g. what number is pressed and what word is being formed as well as the whole sentence which is being formed as a result. Special characters like ",", ".", "@" could also be typed either by clicking them with a mouse or touching them on a touch screen.

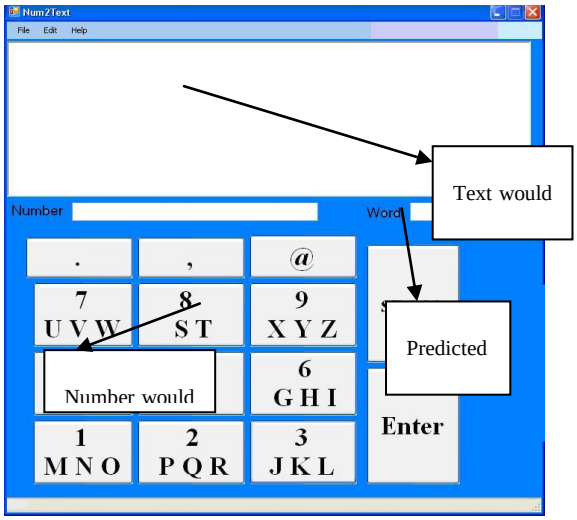

Figure 1 - Num2Text soft keyboard

User can type the numbers which contain the letter of the world and assistive tool predicts the word which can be formed as a result e.g "82561" would mean "Spain". Most frequently used words in English (of, and, a, to, in, is, you, that, it, he, was, for, on, are, as, with, his, they, I, at, be ….) were added to dictionary of the assistive tool though it allows new words to be added to the dictionary [8].

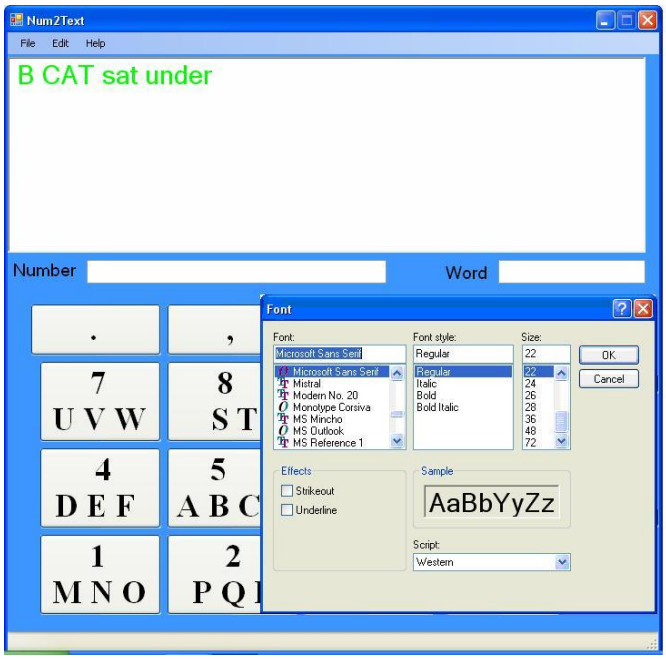

Figure 2 – Configuring Fonts and Colours)

Assistive tool also allows the user or carer to customise the font size and colour of the text (figure 2). Keys are of large size for better visual feedback to the user. Assistive tool also allows user to save the typed text in Rich Text Format which can be later opened with word processors to perform more operations on typed text or to copy and send it as an email.

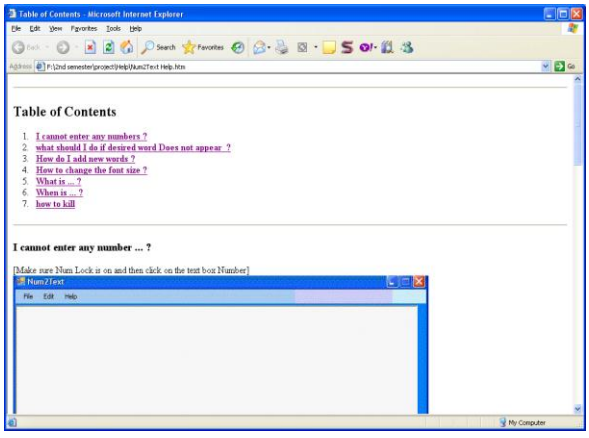

Figure 3 – Help System

There is also help facility provided for the user in the form of a companion help website which provides answer to frequently asked question with screenshots (figure 3).

III EXPERIMENTAL RESULTS

A test plan was formulated to carry out the test which included the sample word to be typed by users, expected words per minute and expected errors per minute. Assistive tool was tested with both able and disabled participants in thirty minutes session. Two able and one disabled persons tested the assistive tool. Permission was sought from the participant or the guardian of the participants. In addition to this during the development of the prototype it was tested by another participant to improve the design and feature of the prototype. One able participant (age 20, male) reached the speed of twelve words per minute with one error for every two words. Disabled participant (21, male) who suffers from muscle weakness and is unable to use both arms and hands to their full potential reached the typing speed of nine words per minute with one error every three words on average. The typing speed achieved by participants appears very slow but it should be noted that this was their first experience with this assistive tool.

IV CONCLUSIONS

This assistive tool eliminates the need of special hardware keyboards and can be used with existing hardware such as keyboard, mouse or touch screen. This tool allows fast and error free typing after the user gets used to the layout and operation of assistive tool. Prototype can be improved to work with other programs such as word processors to make the assistive tool more usable.

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