Designing and Evaluating Vibration modes in Braille Glove Vibration System for Disabled Persons

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Abstract

Braille is an important language used by the visually impaired to read and write. It is vital for communication and educational purposes. The Braille code has become the main system for the majority of those blind people who read and write using tactile approach. Tactile means sense by touching or rubbing the surface of the corresponding output device This paper proposes a vibrating Braille glove which helps the deaf and blind people benefit from the latest computer technology, by means of a vibration inside the hand glove. This is connected to a computer using hardware control procedures and a screen input program for communication purposes. The vibrations in six different positions in the hand glove match the Braille code. So the blind person can understand the characters of English language. In this study it explains the software design of English text to Braille code conversion, Hardware design of Braille Hand glove, Braille equivalent vibrations in six different positions in the Braille glove using hardware control procedure numbers and how it is tested using serial and parallel mode. This system puts forward the new idea for the benefit of deaf and blind people, who prefer to work in computer environment.

Keywords: Electronic, finger tips, motor, Sensation, signal, translator.

1. Introduction

All over the world, persons who are visually impaired have used Braille as the primary means of accessing information. Also, the concept of Braille has been accepted as a universal approach that works across the boundaries of the world. Different countries of the world have adapted the system of Braille to suit their languages. Irrespective of these changes or modifications, visually disabled persons understand standard Braille for the English language making it possible to exchange information in a consistent fashion across different countries. Standard Braille is an approach for creating documents which could be sensed through touch. This is accomplished through the concept of a Braille cell consisting of raised dots on thick sheet of paper. Also there are several communication methods that involve tactile sensation, such as Braille-Based touch screen Device [1], Braille text on a finger using Braille pin method [2] portable Refreshable E-Braille [3] and Braille emulator method [4]. However, some problems arise in such conversion, like lack of privacy for deaf and blind people, complexity operation and mismatch for computer environment. Also visually impaired person having problem like long term diabetics often have a condition known's as "diabetic neuropathy" [5] a circulatory problem causing many of the complications that the diabetics might encounter. Neuropathy causes not only insensitivity in the fingertips and toes; it

causes more blindness, kidney failure, heart. The continuous readings in Braille produce swelling in the ankles which cause reading times to be very slow[6][8]. Up to now for reading and getting information the blind people have been relying on printed Braille sheets, which have protrusions on the printed sheet in a set pattern. This system intends to revolutionize the method of a communication for blind people by using the vibrating hand glove, which vibrates at six different places corresponding to the six positions in a Braille sheet used for denoting various characters. A normal person who wants to communicate with a blind person, types the keyset into an input screen of the software tool. The software program converts the text into ASCII values and activates the corresponding vibration in the hand glove. This procedure makes it an easy and fast method for blind people to receive information [7].

2. Literature Review

People who have both sight and hearing impairments are known as deaf and blind. Because of their impairments they face many problems in their normal daily life. It is particularly difficult for totally deaf and blind people to acquire vital and sufficient information necessary for daily living, compared with sighted hearing people. In standard Braille, the concept of a Braille cell consisting of 2*3 cells . It is raised in sheet
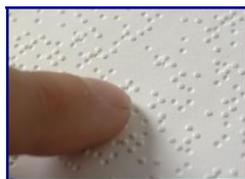

Fig. 1: Braille sheet

as mentioned in Fig. 1. The protrusion of the dot is achieved through a process of

of raised dots on thick sheet of paper as embossing. A visually impaired person is taught Braille by training him or her in discerning the cells by touch, accomplished through his or her fingertips. The image in fig 1 shows how this is done. Each arrangement of dots is known as a cell and will consist of at least one raised dot and a maximum of six. The visually impaired person can touch the raised position of each Braille cell from left to right in the Braille sheet using their fingertips and understand the equivalent English letter value. Braille uses a group of six raised dots which are arranged in a matrix of three rows to two columns. These positions (raised or flat) are used in combination to give 64 (2^6) different Braille characters. This clearly means that there is a one to one correspondence between Braille characters and English text . The formation of English alphabets as represented in fig 2 as follows:
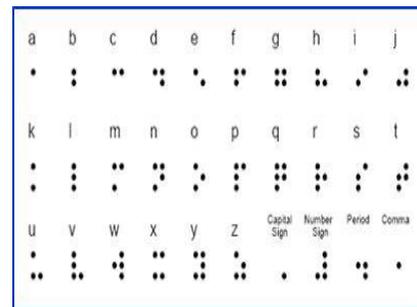

Fig. 2: English alphabets

3. Proposed System

Braille is a method of representing characters through a pattern of raised dots so that the blind can read by the sensation of touching. Written communication between two people is an easy task provided that they can both read and write the same language. So the methodology of the system is "To design a translator for converting English text to Braille code and this Braille code into vibration signal". The methodology of invention for Braille Hand Glove vibration

is to investigate a novel approach to computerize the conversion of English text to Braille Code and on to vibration.

4. Software Implementation

The software screen design is used to get the new technique and communication for for blind persons. The Braille glove is const -ructed with six vibration motors .

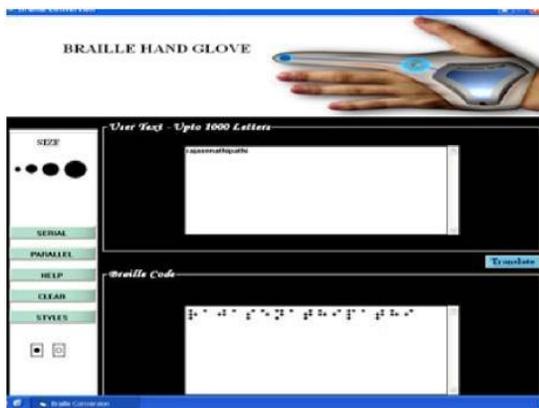The Screen layer is designed as follows:

Fig. 3: Screen layout for Braille code

Figure 3 shows the Braille Input screen. It accepts the user typed information as input and converts input English text to Braille code using Braille database. The converted Braille code is passed to hardware algorithm and is written in HIGH TECH C language.
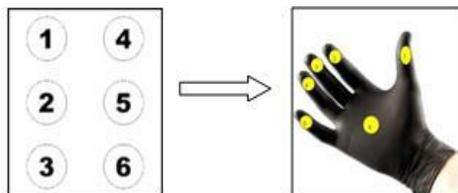
5. Hardware Implementation

Fig. 4: Hand glove with six positions

The design of a Braille Hand glove,

comprises of a majority of electrical components, the design aims to produce a product to perform vibrations in six positions of a blind person's right hand as represented in Figure 4. A low cost and robust design will provide the blind person with an affordable and reliable tool as it gives a new technique and communication method for blind persons. The Braille glove is constructed with six vibration motors. These are fixed in five fingers and the centre of the palm positions of the glove.
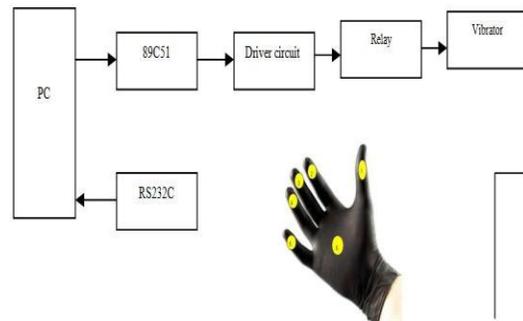
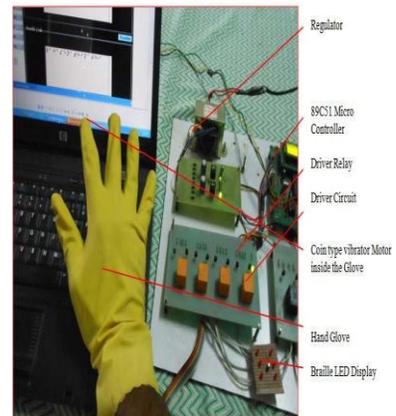

Fig. 5: Block diagram of hand glove vibration system

Fig. 6: Hardware prototype of hand glove vibration system

The presence of 1's in a six digit binary value is nothing but rising position of the Braille symbol. So based on the position the

blind person can sense the value of the letter. This conversion program is written in HIGHTECH C language and it is recorded in the micro controller of the hand glove. Any blind person can wear this glove in right hand and understand the English letters through vibration instead of touching the Braille sheet. Similarly the whole word or sentence is converted into Braille vibration and sent to the blind person. Based on this method the visible person and deaf and blind person can communicate effectively.

6. Result and Discussion

Both Hardware and Software Translation programs are written in an incremental fashion. Each section of code is verified, tested then it is implemented. This starts with reading the rules (based on Software and Hardware algorithm) from a text file, separating them into fields and matching each field and applying the rule. Consequently debugging and corrections are made to the code at all steps of development. Both programs work well and have not had any fatal errors. The execution time of the programs on the Braille Glove when translating a hundred characters into vibrations is under a few seconds making them acceptable for use by Blind people.

The major concern for results came from the accuracy of the translations. Without a detailed knowledge of Braille the most efficient way of testing the results of translations was by comparing it with other texts in manual. If the translations were wrong or incorrect then the results would be inaccurate. It is used to test the system with newspaper heading as input then the corresponding Braille Code and Braille vibrations are measured by visible (normal) and blind person. The output box of Braille software is tested with comparison of Automated Braille code and Braille code in printing materials. This testing has proved that there is 100% accuracy for Braille text conversion in software. Also Braille glove is working with 100% accuracy in vibration for corresponding position and every conversion is done automatically. This vibration is recognized easily by blind people due to their previous knowledge in Braille code. But people without knowledge of Braille feel it difficult to recognize the positions in Braille Hand glove. In this case the conversion procedure is repeated several times up to their satisfaction. A sample test value is recorded as follows:

Mode	Message	Blind people Recognition		Visible people recognition	
Serial recognition	Touch screen computer	B1	100%	v1	90%
		B2	100%	V2	90%
		B3	100%	V3	80%
		B4	100%	V4	80%
		B5	100%	V5	100%

Table.1: Serial recognition test

There were 10 participants, 5 sighted and 5 blind. The visible (normal) participants comprised 3 males and 2 females, with ages ranging from 19 to 36 years, all of whom were university students with no reported sensory. The blind participants comprised 4 males and 1 female, with ages ranging from 19 to 54 years.

Mode	Message	Blind people Recognition		Visible people recognition	
Parallel recogniti on	Be simple be sample	B1	90%	v1	80%
		B2	90%	V2	80%
		B3	100%	V3	70%
		B4	100%	V4	70%
		B5	100%	V5	80%

Table.2: parallel recognition test

These participants had no useful vision but reported having no other sensory or motor impairments. Of these blind from birth or blind for an early age and the remaining 2 lost their sight between the ages 10 and 43. All blinds were from Ramakrishna University for Disabled between the ages 10 and 43. All blinds were from Ramakrishna University for Disabled person and experienced in Braille fundamentals. Visible persons are represented as V1, V2, V3, V4 and V5 and Blind persons are represented as B1, B2, B3, B4, and B5. The comparison of blind and sighted person is diagrammatically represented as follows:
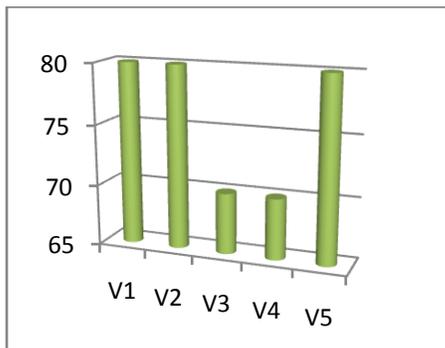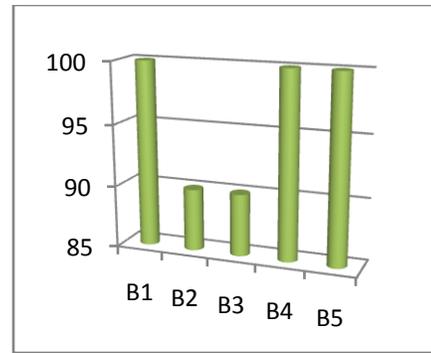

Fig.7: Visible Person Recognition

Fig.8: Blind Person Recognition

The little drop in accuracy in parallel Recognition mode of the translation by visible person was mainly due to mixing of digits and alphabets. Also it produces high vibration speed when compared with serial Recognition mode. It is easily handled by blind people due to experience in Braille code. But visible person can feel little difficulty but it can be rectified by decreasing the speed of vibration in hand glove.
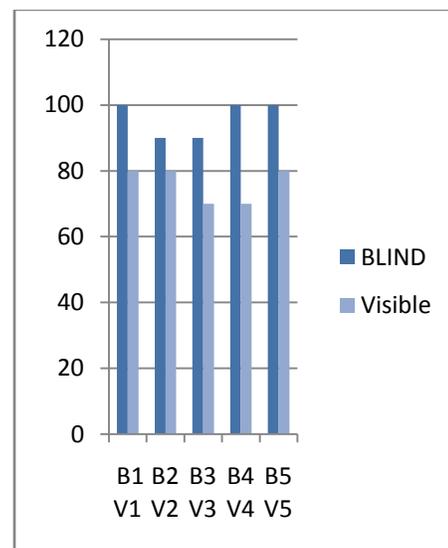

Fig.9: Recognition Comparison of Blind and Visible Person

In serial mode two seconds is set as time delay between Braille position and six seconds is set as time delay between Braille characters. But in parallel mode Braille positions are vibrated simultanesoly and six second set as time delay between Braille characters due to fast Braille recognition.

7. Conclusion and Future work

The software algorithm which is coded in Visual Basic 6.0 reads the sentence from the Input box of the Braille software tool and breaks them into characters and are counted up to the value of the enter key. The Braille code equivalent of each character is digitallygenerated in the output box of the tool. The hardware algorithm which is coded in Hi-Tech C language reads each character from the Input box of the Software tool and converts into ASCII value. The presence of 1's in a six digit binary value is nothing but raised position on the Braille symbol. This activates the corresponding vibration motors in the hand glove. Through this vibration signal the blind person can infer the corresponding English letter. In order to interact with the blind or blind and deaf person, the visible person types on the Input box of the software tool and this interaction is sent as vibrating signal to the blind or blind and deaf. At the same time it is little difficult for visible and deaf and blind people, because the vibration is initially felt difficult to recognize the six positions inside the hand glove, but once they get experience or few repetitions, anyone can use this system for effective communication purpose. Most of the blind users feel that no difference is found between the Braille cell position inside the glove and Braille impressed sheet. The Braille code vibration process is a single step and the data transfer rate is normal and it is controllable. It is the best tool for visually impaired people to have more accurate sensing, low error rate, small electronic product and it proposes a new approach to blind persons to know about computer oriented technologies.

References
[1]   Boaz, L., Embedded based embossing method for braille letters by braille binary values. Int. J. Eng. Res. Appl., volume 3,Number 2, 2013
[2]   Deepak, K. and A.Q. Mohammed, Mobile application and E-classes for increasing the availability of information for visually impaired persons. Int. J. Mach. Learn. Comput., Volume 1, Number 3, 2011.
[3]   Hassan, M.Y. and A.G. Mohammed, Conversion of English character into Braille using neural network. Int. J. Comput. Commun. Control, Volume 11, Number 2, 2011.
[4]   Parinyarat, T., S. Atiwong and P. Proadpran, Finger Drift Compensation (FDC) model for Braille input. Int. J. Comput. Sci. Elect. Eng., Volume 1, Number 3,2013.
[5]   Raja, M.A., A. Arunya, Y. Dipti, G. Kanitha and R. Maheshwari, Portable refreshable e-Braille. Int. J. Eng. Res. Appl., volume 3,Number 1, 2013.
[6]   RajasenathipathiM.,Shivakumar,B.l.,A new approach for Hardware control procedure used in Braille Glove Vibration system for Disabled persons,Research journal of Applied Sciences,Engineering and Technology Volume 7, Number 9,2014..
[7]   Santanu, H., H. Abul, K. Amina, B. Debotosh and N. Mita, Development of a Bangla Character Recognition (BCR) system for generation of Bengali text from braille notation. Int. J. Innov. Technol. Expl. Eng.,Volume 3,Number 1,2013.
[8]   Shahab, A. and H. Violeta, Electronic braille document reader. Int. J. Sci. Knowl. Comput. Inform. Technol., Volume2, Number1, 2013.