Body-Braille System for Disabled People

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Abstract. This paper introduces the Body-Braille system which has been developed as a new communication channel for deaf-blind people using 6 micro vibration motors to present a Braille character and describes the support system using the Japanese mobile communication system combined with Body-Braille. Body-Braille has several advantages compared to other Braille systems. The control device of Body-Braille is named "B-brll" and has several interfaces including RS-232C and DTMF. Some basic experiments to measure the speed of reading Braille were performed and the mean reading time for one Braille cell was 0.5-1.4 seconds, which is fast enough for some useful applications. Using Body-Braille, a Tele-support system was developed as an application and good results were obtained. Furthermore, a newly developed idea which presents Braille character using only 2 points instead of 6 points and new equipment corresponding to this idea which has significant possibility for a very practical products, are described.

Key words: deaf-blind people; daily support; Braille; mobile phone

1 Introduction

Since 2002, we have been developing the Body-Braille system, which allows a user to read Braille characters through six vibration motors settled on the surface of the body such as the back, head or arms. There are some similar studies like supplying the azimuth direction by vibration or the finger Braille system [1][2]. But in the former system, only the direction is transmitted and in the latter system, disabled people can not have their fingers free during reading. Body-Braille is a new Braille system different from the conventional Braille system. We have performed several experiments in which disabled people could get needed support for daily life through Body-Braille. In this paper, a newly developed piece of equipment, a two vibration motor system and its application are described.

2 Body-Braille

As described above, Body-Braille is a new Braille system using 6 micro vibration motors on the surface of the body. Body-Braille is very useful for deaf-blind people as well as visually impaired people. Body Braille has several merits as follows.
-Any part of the body can be used to receive Braille data — a diabetes patient whose finger nerves have become very weak can read Braille through another part of the body.
-Both text and symbol information can be transmitted — text information coded in Braille as well as symbol information such as "over", "under", "right" or "left" using the positions of six vibration motors settled on the body are available.
-Wearable — Disabled people can keep their hands free while reading by Body-Braille, a very useful feature for support during movement.
-Getting information passively — Disabled people can get information without moving their fingers on papers, which means they may read Braille data while doing other housework.
-Useful for a blind adult's study of Braille — Generally it is very difficult for a blind adult to master reading Braille because sensing the convex points with the fingertips is difficult. In the Body-Braille system, if they know only the rules of Braille, they can very easily read Braille characters.

Figure 1 shows a conceptual image of Body-Braille.

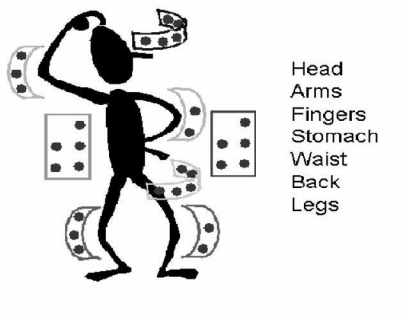


Fig. 1. Conceptual image of Body-Braille

3 Hardware for Body-Braille System

The Body-Braille system consists of a control device named "B-brll" and vibration motors. B-brll has several I/Os. The main input device is eight switches settled on the upper surface of the device. These eight switches are used for

Braille character input: six switches for the six points in one Braille character and two switches for auxiliary functions such as spacing or shifting. B-brll has three types of serial bi-directional communication interfaces: an infrared sensor/diode, an RS-232C port and a DTMF port. The main output device is the set of vibration motors through which the Braille data are transmitted. The drive parameters of the vibration motors can easily be changed according to the preferences of an individual user.

4 The Measurement and Application

In the early stages of development, we performed tests of reading Body-Braille with three blind subjects. Many parts of the body were tested and the results show the most preferable parts of the body for reading are the arms and the back. The questions used in the test were several sets of 10 Japanese words (nouns) each. The subjects replied the word which was read through Body-Braille and if they could answer correctly within three repetitions of the word, it was counted as a correct answer. The mean reading time of one Braille cell at the correct rate is 80% is calculated. The result was 0.5-1.4 seconds. This proves that the Body-Braille system can be a strong channel for communication for disabled people, especially deaf-blind people.

In order to evaluate Body-Braille, we have performed several experiments so far. One is a Tele-support system combining the TV telephone system of a G3 mobile phone and Body-Braille. If a deaf-blind person who lives alone wants to know about something in front of him or her through visual means (e.g., reading some mail or confirming the contents of a bottle of liquid), he or she can get the information by sending a motion picture and getting back Braille data translated by a remote sighted supporter through a DTMF tone signal. We obtained reliable results through the experiments. Figure 2 shows an explanation of Tele-support system.

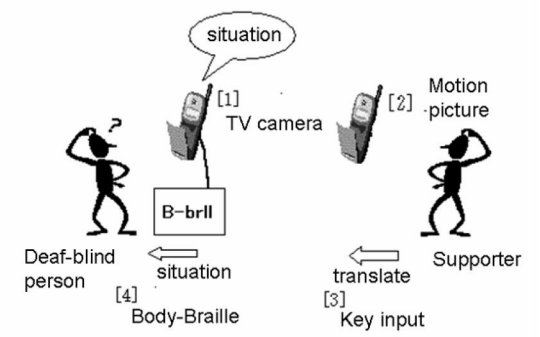
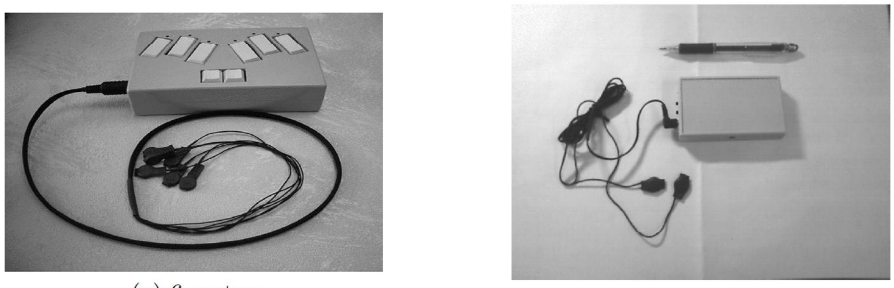


Fig. 2. Tele-support system

5 Improvement of Body-Braille

One current problem with Body-Braille is how to settle the six vibration motors on the surface of the body. We have many ideas corresponding to the body part such as being embedded inside a belt or in the rim of a cap. But if the number of vibration motors is reduced, it would be very easy to settle the vibration motors and then reading errors caused by mistaking the motor position would decrease. For that purpose, we are studying a simplified Braille system, in which Braille characters are presented using only two points, instead of the original six points. In this system, the two vibration motors are driven three times for each Braille cell. For the row which doesn't have any convex points, a very short vibration is assigned. With this simpler Braille code, we can use fewer vibration motors which is convenient for body parts having a small area. Figure 3 shows the exterior view of the equipment of 6 motors and 2 motors.



(a) 6 motors (b) 2 motors

Fig. 3. Exterior view of B-brll for 6 motors and 2 motors

6 Conclusion

We have been developing the Body-Braille system which is available for both deaf-blind people and visually impaired people. We have performed basic experiments in which the basic data were collected and application experiments which proved the usability of Body-Braille. Now we are developing a new Body-Braille system which uses a reduced number of vibration motors which makes Body-Braille much more practical in daily life.

References

1. A. Rupert: An instrumentation solution for reducing spatial disorientation mishaps, IEEE Eng. in Med. and Bio. 2000, pp.71–80 (2000)
2. Amemiya, A. Hiyama, M. Nakashige, S. Fukushima, K. Hirota and M. Hirose: Wearable Finger Braille Inter-face for Navigating The Deaf-Blind, HIS Report, Vol. 4, No. 3, pp.11–14 (2002) (in Japanese)