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Support Systems for Impaired People Based on MY VISION

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Abstract. MY VISION is a project focusing on 'the third (virtual) eye of a person' for recognition and analysis of objects in a momentarily changing real environment. This paper describes some portable systems for supporting impaired people. Three types of support systems are currently under development, i.e., (i) a navigation system for a visually impaired person to walk on a road and cross a crossroad safely by discriminating obstacles and pedestrians surrounding him/her and by finding traffic signals, (ii) a public bus finding system for a visually impaired person when going out, and (iii) a portable communication system for an orally impaired person to realize smooth transmission of his/her intension.

1. Introduction

The construction of the social infrastructure that provides people with safety and relief has been bringing a great benefit for their social life. On the other hand, the daily lives of impaired people do not receive such a benefit unlike commoners. According to the report of World Health Organization (WHO) in 2017, the number of worldwide visually impaired people is estimated at 253 million, and around 81% of them are age 50 years and above. Furthermore, the vast majority of them live in low-income. As for the auditory impaired or orally impaired people, they are estimated at about 360 million, and 32 million of them are children. In Japan, more than 330 thousand people are visually impaired [1] while auditory impaired people are about 360 thousand [1]. Owing to the issue of Japan's extreme population aging, the number of both impaired people will go on increasing.

Various practical aids such as a guide dog, a security stick, braille reader/writer and studded paving blocks at the public places are provided to support visually impaired people. Some devices attached on a human body, e.g., on-shoe sensors [2], tactile display and vibration sensors [3], have been proposed. However, visually impaired people face various problems in a daily life: They loss a direction when travelling from one place to another: They feel danger to cars in traffic congestion or rainy weather: They also feel puzzled over the obstacles left on the road, or bicycles or motorcycles parked in a prohibited area.

For an orally impaired person, on the other hand, a sign-language is used for communication between impaired people. But for communication with ordinary people, the most common tools are writing materials or a sign-language interpreter. A sign-language may be easy for the congenital impaired but it may be difficult for those not born impaired. Instead of writing or using an interpreter, various systems on automatic sign language or finger spelling recognition [4,5,6] have been developed. However, they rather put emphasis on the recognition aspect of a sign language or finger spelling and assume that a camera is set on the side of an ordinary people. This latter fact prevents those systems from putting into a practical use in a daily life of an impaired person.

For the above reasons, it is necessary to realize a practical support system for the visually impaired and orally impaired people to be able to live a life in safety and relief and convenience. From the

perspective of portability and practicality, we propose a MY VISION system to solve some aspects of the problems which impaired people experience.

In Section 2, we will introduce the MY VISION systems for visually impaired and for orally impaired people, followed by some experimental results. Discussion and conclusion are given in Section 3.

2. MY VISION

2.1 A Navigation System for a Visually Impaired Person

In our daily life, a large amount of visual information is required when one goes out. It is a simple daily activity for ordinary people, but is not simple for visually impaired people, because, in a real environment, they need to pay lots of attention to other objects such as pedestrians, bicyclists, traffic signals or even guide signs which often appear around them. As Fig. 1 illustrates, a walking environment analysis system called MY VISION [7] is proposed to obtain various kinds of information necessary for safe outdoor walking. In Fig. 2, MY VISION extracts some features of the background and estimates the situation of the walker (assumed visually impaired). If the estimated situation is normal walking, the safety sidewalk area is extracted, and, if a certain obstacle exists on the road in front of the walker, it is detected, and notification is sent to the walker. As Fig. 3 illustrates, if the walker is just before a crossing, the crosswalk and the traffic light set there are detected and the signal color, green or red, is recognized. Furthermore, a crosswalk sign, if it exists on the way, is detected to help the walker know the existence of a crosswalk.

Fig. 1. MY VISION.

(a) frame 1 (b) frame 60 (c) frame 90

Fig. 2. Experimental results of MY VISION: (a)-(c) A walking road area is detected (blue), and a safe walk area is indicated by a red rectangle for a walker: (c) An obstacle (a bicycle) is detected, and the red circle in the top right of the image implies that it was informed to the walker.

(a1) frame 1 (a2) frame 140 (b1) frame 1 (b2) frame 170

Fig. 3. Experimental results of MY VISION: (a1) Before crossing, a traffic signal is detected and indicated by a green rectangle; (a2) Crossing the crosswalk: (b1-b2) A crosswalk sign is detected on the road and is shown by a blue rectangle.

2.2 A Public Bus Finding System for a Visually Impaired Person

Like an ordinary person, a visually impaired person uses public transportation, in particular, a bus, as it is convenient and cheap compared to a taxi. But, when the person waits a bus at a bus stop, he/she should be informed at an early stage that a bus is approaching and where its entrance is when it comes to a bus stop. The MY VISION [8] includes a method of detecting an approaching bus and finding its entrance from a video provided from an ego-camera. As shown in Fig. 4, the method detects a distant bus coming toward a system user and finds its entrance when it comes close to him/her. These kinds of information are successively sent to the user.

2.3 A Portable Communication System for an Orally Impaired Person

Besides visually impaired, the MY VISION also works practically for orally impaired people [9]. Orally impaired people normally use a sign language (SL) including finger-spelling. Every existent SL recognition system puts a camera facing at a person: This restricts the place of use and hence makes the person give up bringing it out for talking to ordinary people. The MY VISION includes a method of recognizing finger-spelling from a video given by an ego-camera. The system produces unlimited words by acquiring only 45 or so Japanese finger-spelling characters and realizes a portable system which an orally impaired person can bring out and communicate to an ordinary person. Some images are shown in Fig. 5, where a user performs the word O-ha-yo-u (Good morning) by the system.

3. Conclusion

Some results of our MY VISION study were introduced, in which new systems and a tool were shown that give some help to visually or orally impaired people: Some systems contribute to visually impaired people for their safe and convenient move, whereas a new portable tool is proposed for better communication of orally impaired. The idea of MY VISION is to make the third, virtual, eye of a human. We believe that to make the best use of this eye will increase the QOL of impaired, or even aged, people to a large extent.

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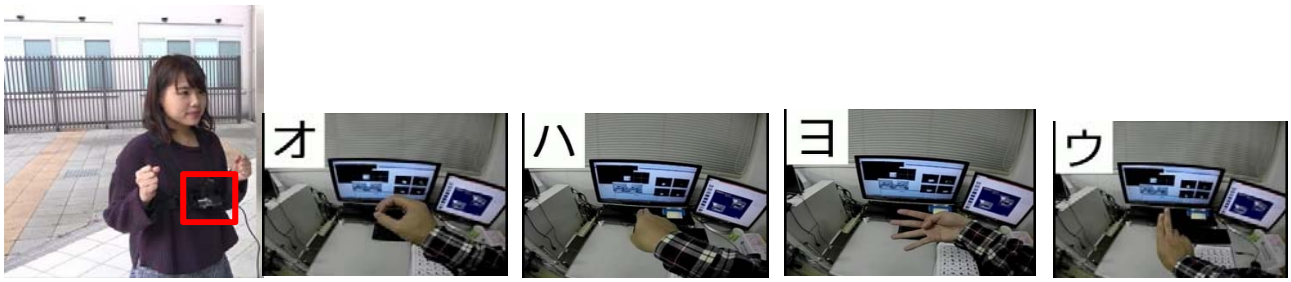
(a) (b)

Fig.4. Experimental results of MY VISION: (a) A distant vehicle recognized as a bus indicated by a red rectangle; (b) An approaching bus and the entrance shown by a blue rectangle.



(a) (b)

Fig. 5. Experimental results of MY VISION for an orally impaired person. (a) Overview of the system (A red rectangle surrounds a camera); (b) Japanese finger spelling saying 'o-ha-yo-u' (Good morning).

References

[1] Ministry of Health, Labour and Welfare, The investigation on physically impaired children and adults in 2006, pp.3-16, 2008.

[2] R. Velazquez, O. Bazan, and M. Magana, "A shoe-integrated tactile display for directional navigation", ***Proc. International Conference on Intelligent Robotics and System***, pp.1235-1240, 2009.

[3] L. Jones, B. Lockyer, and E. Piateski, "Tactile display and vibrotactile pattern recognition on the torso", ***Advanced Robotics***, Vol.20, No.12, pp.1359-1374, 2006.

[4] T. Goegring, X. Yaang, J.M. Monagham and S. Bleeck, "Speech enhancement for hearing-impaired listeners using deep neural networks with auditory-model based features", ***Proc. 24th Signal Processing Conference***, pp.2300-2304, 2016.

[5] S. Liwicki and M. Everingham, "Automatic recognition of finger spelled words in British Sign Language," ***Proc. of the IEEE Conference on Computer Vision and Pattern Recognition Workshop***, pp. 50-57, 2009.

[6] H. Brashear, H. Henderson, K. Park, et al., "American sign language recognition in game development for deaf children," ***Proc. of the 8th International ACM SIGACCESS Conference on Computers and Accessibility***, pp. 79-86, 2006.

[7] T. Kumano, J. K. Tan, H. Kim and S. Ishikawa, "Traffic signs and signals detection employing the my vision system for a visually impaired person", ***International Journal of Research and Surveys, ICIC Express Letters, partB: Applications***, Vol.7, No.2, pp.385-391, 2016.

[8] K. Ishitobi, J. K. Tan, H. Kim and S. Ishikawa: "Detection of a specific moving object from head-mounted camera images", ***IEEE International Symposium on System Integration***, 6 Pages, 2017.

[9] J. K. Tan, S. Hamada, M. Hirakawa, H. Kim and S. Ishikawa, "An ego-camera based finger-spelling recognition system", ***Proc. of the International Conference 2016 IEEE Region 10 Conference (TENCON)***, pp.358-363, 2016.