Sign Language Support System for Viewing Sports Programs

Tsubasa Uchida, Taro Miyazaki,
Makiko Azuma, Shuichi Umeda, Naoto Kato,
Hideki Sumiyoshi, and Yuko Yamanouchi
NHK (Japan Broadcasting Corporation)
Tokyo, Japan
+81-(0)3-5494-3438
{uchida.t-fi, miyazaki.t-jw, azuma.m-ia, umeda.s-hg,
katou.n-ga, sumiyoshi.h-di, yamanouchi.y-fg}@nhk.or.jp

Nobuyuki Hiruma

NHK Engineering System, Inc.
Tokyo, Japan
+81-(0)3-5494-3386
hiruma.nobuyuki@nes.or.jp

ABSTRACT

To expand the services that are based on Japanese Sign Language (JSL) for deaf and hard of hearing people, we developed a support system for viewing sports program. The system provides sign language computer graphics (CG) animations and other auxiliary information such as text, image, and notifications automatically generated from game metadata. Results obtained from gathered opinions showed that the system is effective for understanding the situation when a game is interrupted.

CCS Concepts

• **Human-centered computing** → **Accessibility** → **Accessibility systems and tools** · **Social and professional topics** → **User characteristics** → **People with disabilities**

Keywords

Japanese Sign Language; JSL; Accessibility Technology; Avatar;

1. INTRODUCTION

Deaf communities in Japan are strongly demanding more sign language services. Although sign language interpretation should be provided by human beings, this is difficult due to the shortage of interpreters. To expand the services based on Japanese Sign Language (JSL), we have developed a system that generates computer graphics (CG) animation of JSL gestures. In this report, we describe our prototype support system that aims to enable deaf and hard of hearing viewers to enjoy viewing sports programs.

2. RELATED WORK

Weather information is a quite suitable first approach for sign language animation systems. Since the domain includes many fixed pattern expressions, various studies have been made about sign language weather forecasting [1][2]. We also selected weather information as the first research target, and developed a prototype system for automatically generating JSL CG animations using fixed-pattern weather forecast data [3].

We are now expanding our domain to sports, which requires more vocabulary and more real-time content generation than that needed for weather information. Several studies tried to generate sign

language CG animations on the basis of sports game data [4][5]. However, in these previous studies, the sign language CG animation was completely independent from the game coverage. Of course, as game coverage is very important for people watching sports programs, appropriate support for sign language should reflect the content without disturbing one's viewing. To address these issues, we developed a prototype support system for viewing sports programs by substituting sign language CG and other auxiliary information such as text, images, or notifications using fixed-pattern data distributed during sports events.

3. Support System Overview

3.1 Prototype system configuration

We developed a prototype support system for viewing sports programs. Figure 1 shows its configuration.
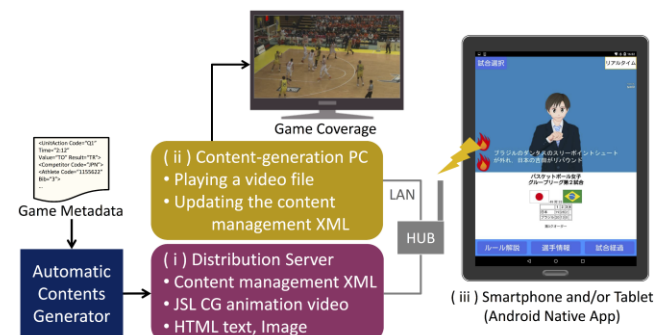

Figure 1: Configuration of the prototype support system.

(i) Distribution Server: The server holds distribution data for events such as JSL CG animation video files, HTML text, image data, and content management XML for managing them. Two types of content management XML are prepared. In the video XML, a JSL CG animation video related to the occurring event, a link to the latest HTML text, and an image are described. The real time XML includes five levels of sound to represent the excitement in the game coverage, and flag information for the timing of a whistle or buzzer in the case that game interruptions are described.

(ii) Content-generation PC: The PC plays a video of the game coverage and updates the content management XML in the delivery server. It synchronizes the timing of the coverage with various contents.

(iii) Smartphone and/or tablet: The application acquires various data on the distribution server, and sequentially displays the contents on the screen. We decided to use a smartphone and/or

tablet to provide the support information as it would be desirable to avoid hindering the game coverage with sign language on the same screen.

3.2 Application details

The application provides JSL CG animation and other auxiliary information corresponding to the game situation. The application UI and function are shown in Figure 2.

JSL CG animation: The application displays three types of JSL CG animation: the game situation, the rule commentary, and the game digest. These animations were generated as MP4 videos automatically in advance on an event basis using game metadata sent in real time. The game situation video is automatically played to match the game coverage's timing, and the rule commentary and game digest videos are played at the timing specified by the user.

Other auxiliary information: The application complements audio information by using the vibration function of the smartphone or tablet with images and text information. The sounds of whistles and buzzers are important to understand what is happening in the game, so using the device's vibration function helps viewers understand the content of sports programs. As well as that, for interpolating realistic sensations such as the voices of an excited audience, the sound level of the game coverage in real time can be visualized by the number of icon images given. In addition, the latest score and player information can be also presented in text and images.

Function	Contents	File Format	Timing
Game situation	JSL CG	MP4	Automatic
	Text Image	HTML	Automatic
Rule commentary	JSL CG	MP4	Manual
Game digest	JSL CG	MP4	Manual
Sounds of whistles	Vibration	XML	Automatic
Sound level of the game coverage	Image	XML	Automatic
Player information	Text Image	HTML	Manual

Figure 2: Main screen and function of the support application.

4. Opinion Survey

On the basis of the prototype system, we built a demonstration environment for basketball games, and conducted a survey to gather the opinions of deaf and hard of hearing people on the system. The survey participants, whose age ranged from 20 to 40 years, were four deaf people (two females and two males) and one male (Coda) sign language interpreter who had been born to deaf parents. They were shown a video of a basketball game that was about three minutes long and included scenes in which the referee blew his whistle and interrupted the game. The application provides 13 game-situation videos, three rule-commentary videos, and three digest videos conveyed in JSL. The content on the demonstration system was generated manually from actual metadata. The questionnaire included queries about the need for JSL videos, the delay tolerance of displayed JSL content, and eye-movement workload. The various opinions gathered were basically classified into positive and negative comments as follows.

Positive opinions: The many positive comments gathered included opinions that JSL and other support information was helpful for understanding the situation when the game was interrupted. Some participants also commented that their

enjoyment of the game was furthered by rule explanations in JSL, which helped them to understand unfamiliar terms, and by statistical information about the players.

Negative opinions: As we had anticipated, there were a number of comments stating that the JSL video was not necessary for the event to be understood when watching only the game video. Some participants also recommended that it would be better to overlay JSL video on the game video for reducing eye-movement workload.

Taking the opinion gathering results into consideration, we concluded that the ideal function of the support system would be for the user to be able to access the information subjectively at his/her convenience when needed. We are gathering opinions from various people of different ages, sexes and sports preferences; however, the support information required will depend on various factors, such as personal preference and affinity for sports. Although the system has only been tested for basketball games, we estimate that the necessary support information and presentation timing will change if the event type is changed. We will continue to verify the functionality of the system, and also carry out quantitative evaluation experiments of an improved system based on system requirements in the future.

5. CONCLUSION

We developed a support system for viewing sports programs using a sign language CG system. The results obtained from gathered opinions showed that several of the system functions are effective for enabling viewers to better enjoy sports programs. We are now gathering opinions on the system from deaf and hard of hearing people and incorporating those opinions into the system by adding necessary functions or deleting unnecessary functions. In the future, we will improve the system with the goal of producing services that can be provided when broadcasting sports events such as the Olympics, Paralympics and Deaflympics.

6. ACKNOWLEDGMENTS

7. REFERENCES

[1] I. Zwitserlood, M. Verlinden, J. Ros, and S. van der Schoot, "Synthetic Signing for the Deaf: eSIGN," Proceedings of the Conference and Workshop on Assistive Technologies for Vision and Hearing Impairment, CVHI 2004, 2004.

[2] J. Oh, S. Jeon, M. Kim, H. Kwon, and I. Kim, "An Avatar-Based Weather Forecast Sign Language System for the Hearing-Impaired," Proceedings of the 10th IFIP WG 12.5 International Conference on Artificial Intelligence Applications and Innovations, pp. 519–527, 2014.

[3] N. Hiruma, M. Azuma, T. Uchida, S. Umeda, T. Miyazaki, N. Kato, and S. Inoue, "Automatic generation system of Japanese sign language (JSL) with CG animation of fixed pattern weather information," ABU Technical Journal 264, pp. 2–5, 2015.

[4] M. Romeo, A. Evans, D. Pacheco, and J. Blat, "Domain specific sign language animation for virtual characters," International Conference on Computer Graphics Theory and Applications (GRAPP 2014), pp. 487–494, 2014.

[5] A. Othman, O. El Ghoul, and M. Jemni, " SportSign: A Service to Make Sports News Accessible to Deaf Persons in Sign Languages," Lecture Notes in Computer Science, Vol. 6180, pp.169–176, 2010.