An architecture to generate automatic Brazilian sign language legends into Digital Television Systems

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ABSTRACT

In this paper, we present an architecture solution for improving sign language, specifically Brazilian Sign Language (LIBRAS), in Digital Television Systems. The proposed solution turns possible that deaf people understand TV audio stimulus by using a sign familiar language (LIBRAS). Otherwise, the architecture offers adaptation facilities where regional expressions could be easily incorporated to the LIBRAS legend.

Categories and Subject Descriptors

K.4.2 [**Computers and Society**]: Social Issues—Assistive technologies for persons with disabilities D.4.7 [**Organization and Design**]: Interactive systems

General Terms

Design, Experimentation, Human Factors.

Keywords

Digital TV, Accessibility,

1. INTRODUCTION

Sign languages are visual languages used by deaf people to communicate. Therefore, the different deaf communities need a dictionary that associates signs to the words of the spoken language of their country as well as dictionaries which translate signs from a sign language to another. For example, we have the American Sign Language (ASL)[1], British Sign Language (BSL)[2], the Italian Sign Language (ISL)[3] and the Brazilian Sign Language (LIBRAS)[4].

Many works are developed for address deaf people needs, these works offer technological solutions for daily activities which enable people with special needs to watch and understand television, to interact with other people or to write a letter. Describing this scenario we mention the use of emotive captioning in movies and television programs [1] and games for training deaf children [2].

In this paper we approach an architecture that enables the automatic generation of legends in LIBRAS for interactive digital TV programs. The proposed architecture involves a set of software and hardware components integrating broadcasters and digital TV set-top-box.

2. LIBRAS

LIBRAS is the Brazilian Sign Language. It is a visual-gestural language used by the majority of deaf people and recognized by the Brazilian Law No.10436 of 24 April 2002. Additionally we have the standard complement 01/2006 of the Ministry of Communications and the technical standard ABNT NBR 15290:2005. Thus are set rules and guidelines for delivery of audio description, closed-caption and window of LIBRAS in both the analog TV as the digital TV.

LIBRAS is not a simple gesture language, but a way of human expression. LIBRAS language is composed of linguistic levels such as phonology, morphology, syntax and semantics. At the same way that oral-auditory languages, the languages based on signs have lexical items, which receive the name of signals. The only difference is their visual-spatial mode. The communication using LIBRAS is based on a combination of expressions which are the combination of hand movements, points of articulation (local in space or in the body where the signs are made) and facial expressions. Thus, language is a system of transmission of ideas and facts, from communities of deaf people in Brazil. Another important fact is that in LIBRAS there are also regional differences, so you we can find LIBRAS dialects.

The Brazilian government emphasizes that deaf people may use digital television functionalities for translate TV programs into LIBRAS language. In this sense, to issues of accessibility, the use of currently LIBRAS is not restricted to interpersonal

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[1] *www.lifeprint.com/*

[2] *http://www.kwintessential.co.uk/BSL/history.html*

[3] *http://elis.eurac.edu/index_en*

[4] *www.**libras**.org.br/*

communication, LIBRAS is present in products and services for digital television market.

However, the use of LIBRAS in TV programs is quite limited to manual devices where a window with an interpreter of LIBRAS is shown into the original program. Moreover, there is an operational cost involved to generate this kind of translation. Another problem is that these windows are usually produced at national level not considering the regional features of LIBRAS.

The current digital TV systems do not provide mechanisms for automatic generation of the legend in sign language (as LIBRAS). However, digital TV systems allow the transmission of data flows independent of the TV signal. It is important that TV programs have to be offered with several access options. In some cases, TV programs are the only information sources for people with special needs. And they are not the only benefit. The window with a LIBRAS interpreter, for example, occupies a good part of the screen and can be seen as uncomfortable by most viewers. With digital TV, the window can be optional and resizable (as defined by 01/2006 Standard) so the viewer can choose his best option.

The object of this paper is to describe a system architecture that enables the automatic generation of legends in LIBRAS suggesting an integrated process between the broadcaster and TV receivers. The generated legend will be treated at the receiver as an independent elementary stream (ES). The software of the set-top-box however, can offer features such as enable/disable LIBRAS legend, or resize the window. To address the issue of regionalization and to minimize the computational resources needed to generate the display of the legend in LIBRAS, we propose the use of extended memory (such as USB storage devices) as an alternative to store a dictionary of expressions of LIBRAS language. For example, the dictionary used in the south of Brazil may represent the same expression differently than the dictionary used in northeast. But for the system that is transparent and the viewer has preserved his right to attend the most familiar representation.
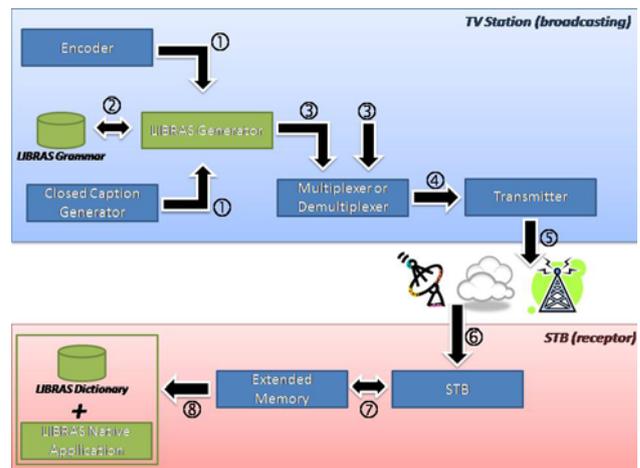
3. THE ARCHITECTURE PROPOSAL

In this section we briefly describe the proposal architecture. The main contribution of this architecture is the use of a LIBRAS dictionary at the receptor. The LIBRAS dictionary is responsible for the storage of visual representations related with the sign language. Each sign (or expression) could be represented by an animated image or a video file (as a png or a video file, for instance) and has a code (or index) associated with it representation.

The proposed architecture is shown in Figure 1. Note that at the TV Station scope, we have special components to generate and transmit the LIBRAS grammar. LIBRAS Generator and LIBRAS grammar components generate an elementary stream (ES) composed by a set of LIBRAS codes (grammar). This stream is multiplexed and transmitted with video, audio and data streams to the receptors. At the other hand, the receptor (STB) decodes the LIBRAS elementary stream by associating each code to it representation on the LIBRAS dictionary.

As indicated in Figure 1, on TV Station, a LIBRAS Generator receives an input stream of audio, video or closed caption from a Video Encoder or a Closed Caption Generator. Therefore, using the LIBRAS Grammar, the LIBRAS Generator automatically generates an elementary stream (ES) composed by a set of codes,

where each code is related to a sign (or expression) in the LIBRAS Dictionary. The LIBRAS ES is then multiplexed (or re-multiplexed) on the MPEG-2 Transport Stream (MPEG-2 TS) and transmitted on the Digital TV signal. On set-top-box, there is an extended memory (such as USB storage device) that stores the LIBRAS Dictionary and a LIBRAS Native Application that uses this dictionary to decode and display the signs on screen. As the representation of each sign is stored in the LIBRAS Dictionary, regional aspects are preserved. The native application can offer features such as resize the window, enable/disable LIBRAS legend. This functionality is important for the viewers those could choose the most familiar representation. In this case, we suppose that the set-top-box support to run native applications from USB storage devices as in [3].

Figure 1 –Architecture Proposal for LIBRAS in Brazilian Digital TV Systems. (1) A/C ES or CC ES (2) LIBRAS grammar (3) LIBRAS ES (4) MPEG-2 TS (5) Digital TV Signal (6) Streams (7) STB Access (8) LIBRAS Dictionary

4. CONCLUSIONS

In this paper, we proposed an architecture solution for improving Brazilian sign language legends in Digital Television Systems. The proposed architecture addresses accessibility features increasing the deaf people interaction into the TV set. Our proposal has an important regionalization requirement that guarantees the LIBRAS dialects preservation. Otherwise, the automatic generation of the legend in LIBRAS is an important innovation function of digital television systems.

5. REFERENCES

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