

SIGN LANGUAGE MMS TO MAKE CELL PHONES ACCESSIBLE TO DEAF AND HARD-OF-HEARING COMMUNITY

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Abstract: Cell phones became extremely popular devices considering their vast utility world wide. However, making cell phones accessible to the deaf and hard-of-hearing community is still a challenge. Main available products on the market for this community offer no more than the possibility to boost/amplify volume. Many cellular provides individual cell phone models which are hearing aid compatible and possess speakerphone capabilities. However, if the user is completely deaf, these phones still tend to be somewhat complex or impossible to use.

Another alternative, based on Video phones messages, are quickly widespread as the preferred method of communicating for the deaf and hard-of-hearing community. However Video phones require significant computer processing power to compress and decompress video in real time. Nevertheless, this alternative still has to overcome the various technological challenges associated with utilizing video phone technology, especially via low bandwidth network.

In this context, this paper describes a new application allowing the use of MMS (Multimedia Messaging Service) to generate sign language animation in order to communicate with deaf people via cell phones. These animations are avatar based animation obtained by automatic interpretation of text into sign language. This application is a new component developed amongst WebSign kernel (Jemni et al., 2007; Jemni and Elghoul, 2007).

Keywords: Accessibility, deaf, sign language, avatar, MMS, cell phone

1. Introduction

Our aim is to give deaf people access to mobile communication using sign language and allow them to communicate with hearing persons thanks to the automatic translation between the two languages. This goal can be achieved by the development of two components: the first concerns the acquisition and the transmission of sign in the GPRS net, however, the second is related to the generation of sign and its transmission.

In our project, we targeted mainly the second component. Our contribution consists mainly, in the development of software module which allows automatic transformation of a textual message to an MMS containing the translation of the message's content to sign language.

The content of this paper is organized as follow: the next section is devoted to present the state of the art related to the use of sign language in the cell phone technologies. In section 3 we describe our objectives and the problematic. Section 4 illustrates the general approach adopted to develop the tool. In section 5 we describe the advantages of MMSSign and finally, in section 6, we present the conclusion and perspectives.

2. State of the art

The first way to use cell phone by hard of hearing or deaf person is the SMS (Short Messaging Service). Unluckily, the majority of deaf persons, especially in developing countries, is illiterate and therefore cannot use cell phones' SMS, further than the preferred language for deaf is sign language (their first language). Due to the cost of SMS and the no connective mode used by the SMS protocol the use of textual message is improved by the invention of the textphone (Day, undated). The textphone is a phone which allows two people to communicate by the use of the messaging text in real time. This phone contains an ergonomic human machine interface to facilitate the manipulation of the device, to send and receive text in full-duplex. This system is more effective than SMS because it uses the connective mode and the same canal as voice. Another way is the use of third Generation services to do the communication with video and voice. This technology allows seeing the interlocutor by a real time and full-duplex transmission of video.

Between several projects dealing with video sign language and mobile phones, we can quote MobileASL project (Cavendar et al. 2006). It is a video compression developed at the University of Washington; it aims to make wireless cell phone communication through sign language. This project allows people who communicate with American Sign Language to use a real time communication with video via the mobile phone. However, due to the low bandwidth of the mobile phone, the best video encoder cannot produce the video needed to be transmitted with an acceptable quality.

Furthermore (WWW1, undated) is a dictionary containing over than 5000 video of British Sign Language signs words. Created by staff at the Centre for Deaf Studies, this dictionary is accessible by mobile phone application via the internet service, for this reasons this dictionary represents a mobile accessory to persons who work with Deaf people, or just want to learn sign language. It contains a very simple interface which is designed for cell phone; it contains an area to introduce words to be translated and an alphabetical list to choose directly words. The user can download and play the sign as many times as he wishes. To try out MobileSign, you can point the browser of your cell phone to www.mobilesign.org and type in the word or check the alphabetical listing.

3. Objectives and Problematic

Our objective is to contribute in the improvement of e-accessibility of deaf community and to make the cell phone a way of communication usable by deaf people. In this context, we developed a new system able to transform the text to MMS containing the video sequence of the text in sign language in a format which can be sent to deaf via MMS. This transformation is realized in two steps: first, a generation of 3D animation of an avatar, by the use of our web-service WebSign (Jemni et al., 2007; Jemni and Ellghoul, 2007). Then, this 3D animation is transformed by MMSSign software to an MMS containing a 3GP video sequence.

In this project, we invested mainly in the design of the general approach for translating texts to sign language and especially in its technological aspect. We spent more than three years to realize an ICT environment that we will describe in more details in next sections. Nevertheless, we present in this section main problems to be overcome in order to realize this ambitious project:

- Contrary to popular belief, unfortunately, Sign Language (SL) is not universal. Wherever community of deaf people exists, a specific SL has been developed. Likewise spoken languages, SLs vary from region to region. Hundreds of SLs exist in the world and are at the core of local deaf cultures (Neidle et al, 2001). Some SLs have obtained some forms of legal recognition, while others have no status at all (Cavender et al, 2006).
- Linguistic treatment: the automatic translation of written text to sign language should not be a word to word translation. As all natural language processing applications, it requires a lot of

information: lexical, grammatical, translation equivalences, etc. The most difficult aspect remains the semantic analysis.

- Technologic problems: the animation of the avatar needs sophisticated programming skills.
- Cost problem: the construction of dictionaries of signs is an expensive operation and needs a lot of time.
- The mobile phone does not contain a 3D accelerator to the 3D scene and it does not contain a big memory to allow the animation of 3D scene.

4. Our solution

4.1 General approach

MMSSign is a converter of textual message to a video sequence in sign language. This system offers to deaf the possibility to use cell phones. In fact, in order to communicate with a deaf person via cell phone, any one can send him a textual message via SMS or via a dedicated web interface (Figure 1 (step 1,7)). The text of the message is then processed by our system and precisely by our MMSSign server. If MMSSign server does not respond to the request in a reasonable period of time the server of the operator should return a negative acknowledgement of delivery (Figure 1 (step 6)).

In the normal work of the procedure, MMSSign server should return an MMS containing the video transformation of the text in sign language (Figure 1 (step 3)) and the operator of the telecommunication becomes the responsible of the deliverance of the MMS.

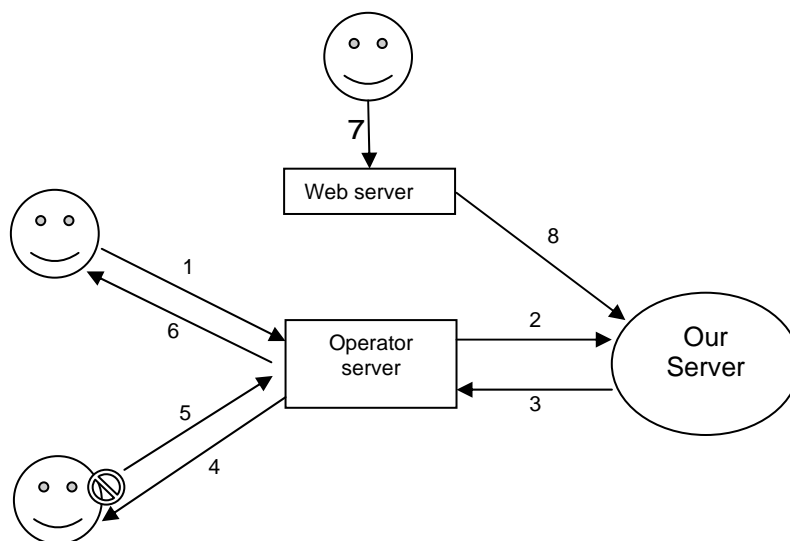


Figure1: General architecture

4.2 Technical architecture

The input of our system is a textual message, this message will be translated to an MMS which contains the translation of the message in sign language. In reality, MMSSign tool is an application developed among another system developed in our research laboratory UTIC and called WebSign (WWW2, undated; Jemni et al, 2007). WebSign is a web-service translator of written text to sign language by the use of avatar technology. At the reception of new message MMSSign sends a request to websign to realize the transformation of the text to a 3D animation of virtual person (Figure2 (step 1)).

This animation is the result of a linguistic process and a translation of words to sign from a dictionary of signs (Figure2 (step 1)).

When MMSSign receives the animation from WebSign, it starts the transformation of the animation to video sequence and therefore it sends it to the server of the telecom operator.

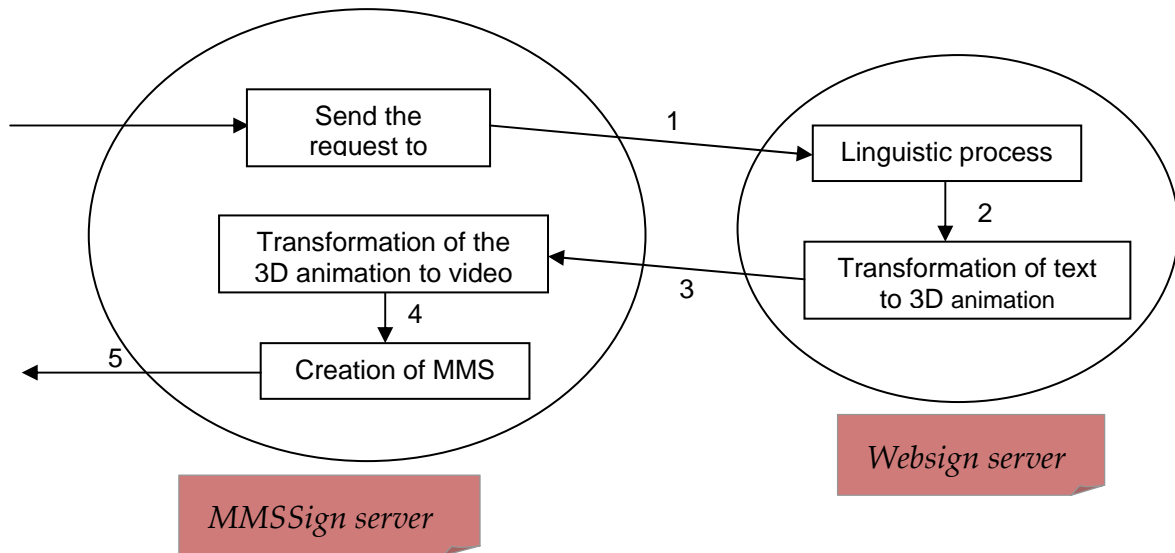


Figure 2: MMSSign architecture

4.3 Websign

WebSign is a Web application developed in our Research Laboratory UTIC (WWW3, undated), based on the technology of avatar (animation in virtual world). The input of the system is a text. The output is a real-time and on-line interpretation of the output into a sign language. This interpretation is constructed thanks to a dictionary of words and signs. The creation of this dictionary can be made in an incremental and collaborative way by users who propose signs corresponding to words. A word and its corresponding sign are added effectively to the dictionary only after its assessment by an expert who supervises the system.

Our system is based on Client/Server architecture (figure 3). To implement this architecture, we have realized the following steps: first, we create the clients, the server and the data base. Second, we saved some animation codes to initiate the data base and finally we have implemented the interpretation algorithm via the service of messaging.

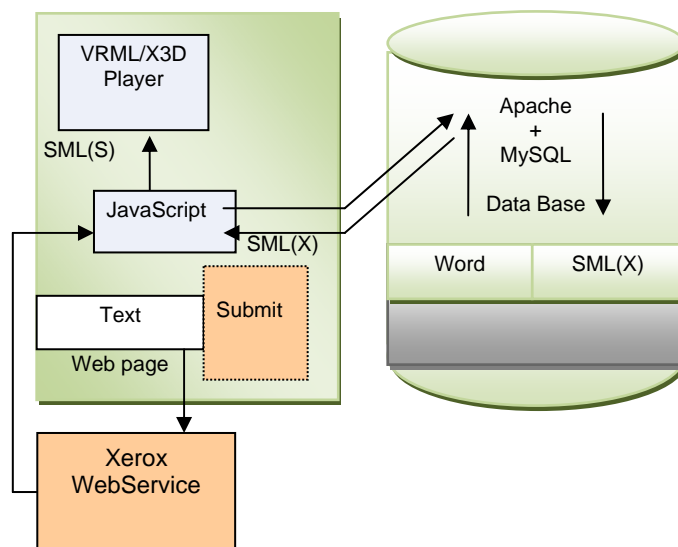


Figure 3. General architecture of Websign.

For the linguistic treatment we have used the Xerox Web-Service (WWW4, undated), available for free, which ensures the segmentation of a sentence and returns the set of segmented words with their grammatical category. These information are important to reduce the error of translation of sentences.

Websign proposes a friendly of use interface which offers the possibility to create easily the sign (figure 4). The user can rotate every join by the use of 3 slides; each slide of them represents the value of rotation of join around a specific axis using the Euler representation of angle. The user can copy, paste, delete, add, or modify the movement. In addition he can do the symmetry of the rotation, clone the movement of one hand to animate the other. The result is stored into the dictionary in XML format (Figure 4) using the H|Anim (WWW2, undated) standard to rename the joins of the armature.

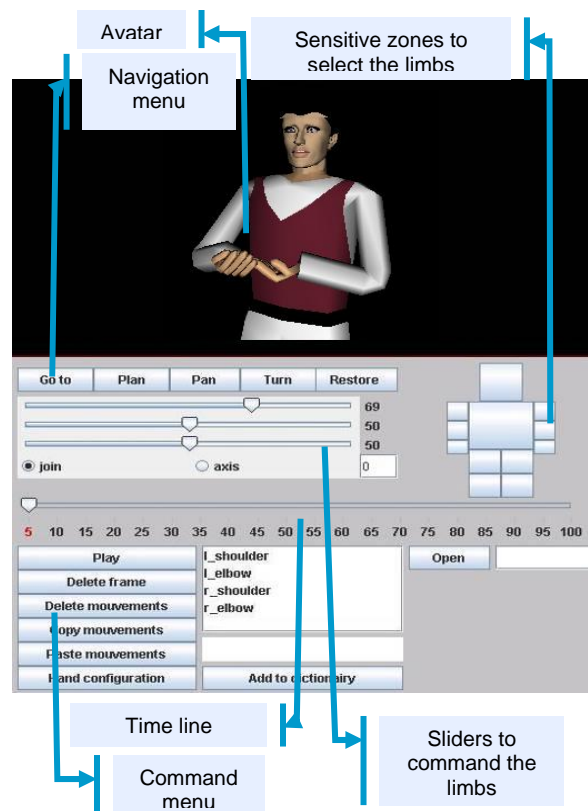


Figure 4: interface of creation of signs

5. Advantages of Our System

The first advantage of MMSSign is that it allows the usability of mobile phone by the deaf society. In addition, without expertise of sign language, a hearing person can communicate with deaf people via the messaging service. Using MMSSign the telecom operator can send news in sign language to the deaf community, or offer services in sign language like the diffusion of weather, GPRS service, etc... Moreover, the telecom operator can send information related to the subscription, like amount or the validity of the subscription.

In addition, this application can be used as a dictionary usable by deaf to learn sign language or hearing who works with deaf people or who likes to learn sign language.

6. Conclusion and Perspectives

We presented in this paper a system we developed to enhance communication with deaf, hard-of-hearing and speech disabled individuals. The originality of this tool consists on the use of new technologies to make the mobile phone a device of communication with deaf people and a tool for the

integration of deaf to the society. We have tested this system by the Bluetooth, and we plan to test it really with an operator of telecom and to make it available as a new service of mobile phones.

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