A Web-Based Tool to Create Online Courses for Deaf Pupils

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Abstract:

It is well known that reading and writing capabilities of deaf persons are less than capabilities of hearing people, although they have the same basic mental abilities. The principal reason for the huge discrepancy between the skills of deaf and hearing persons is due to the socialization of the deaf. This fact, plus the inaccessibility of information through radio and television (due to the lack of subtitles) turn into a vicious cycle which is difficult to break [2]. Furthermore, the sign language is not innate at deaf children and needs specific training. Generally, the first contact of deaf people with structured sign language is when communicating with their deaf peers in specialized schools. In this context, our project aims to contribute in the improvement of accessibility of deaf persons by the use of technologies of information and communication. The objective of our work is to design and to develop a tool for learning and teaching Sign Language for deaf pupils.

1 Introduction

The extraordinary progresses of new technologies related to data processing and to Internet, offer real opportunities to bring a better quality of life to people and in particular, to those that endure handicap. In this context, our project aims to contribute in the improvement of accessibility of deaf persons by the use of technologies of information and communication. The objective of our work is to design and to develop a tool for learning and teaching Sign Language for deaf pupils. This tool is based on the creation of multimedia e-learning course using Websign’s service.

Websign is a web-based interpreter of sign language developed in our research unit “UTIC” [10]. Websign permits to interpret automatically texts in visual-gestured-spatial language using an avatar technology. The architecture is constructed around a virtual person animated by a system of automatic interpretation of text in sign language. This system uses a dynamic data base for sign dictionary that contains gesture codification of words. This tool is presented as a multilingual Web application that offers a full set of interfaces for real-time interpretation, collaborative alimentation of the dictionary and creation of deaf communities in addition to administration interfaces [1].

Our tool is a web-based tool that creates online courses for deaf children. This produced course can be used to:
• help children to learn sign language in their home;
• help normal people to learn sign language;
• it can be used such as a dictionary;
• teach deaf pupils online;

Furthermore, the automatic translation from the written language to the sign language is very complicated and requires the mastering of several domains covering the field of the data processing, of linguistics, or mathematics. A sign language is a language which uses manual communication instead of sound to convey meaning - simultaneously combining hand shapes, orientation and movement of the hands, arms or body, and facial expressions to fluidly express a speaker's thoughts. The sign language remained nevertheless a fully-fledged language, with its own constructional method of the sentences.

Research on automatic interpretation of written text in sign languages and generation of gestural component of spoken languages has been held back by the unavailability of open source computational tools that can be widely used by users. The challenge is to develop computational application that can be deployed via the Web and internet and that gathers two main properties: efficiency and ease of use. Efficiency reports mainly to quick response time and low bandwidth requirements. However the ease of use reports to fullness and conviviality of user interfaces.

This paper is organized as follow: the next section is devoted to present the state of the art related to different systems for e-learning to deaf pupils. In section 3, we describe the different functionalities offered by our tool Websign. We present the general approach we adopt to develop our tool for creating course for deaf pupil in section 4. Finally, we give details for the communication between our system and Websign.

2 E-learning for deaf pupils

Nowadays, to introduce new technologies of information and communication to people with special needs, such as deaf peoples, education becomes a necessity. In fact, in schools dedicated to this community, we can use video, images and others multimedia technologies. In addition to this, handicapped people must participate in all the activities that normal student can do and must be offered the same opportunity to access to these means of information using their own language: signs.

In fact multimedia can be highly useful for the deaf: every pupil can repeat watching sign as many times as required until he understands it or memorizes it.

When creating an e-learning tool for deaf pupil it is very important to choose the most adequate representation of sign. This representation should respond to many criteria: first of all it should be easily understood and adopted to the deaf, second, it should not take a big memory space, and finally, it must be easily adapted with computer technology.

2.1 Writing Based Systems

The first transcription of signs languages is drawing. This represents the means generally used to replace the absence of writing. In a second step, several systems of transcription appeared like HamNoSys and SignWriting to resolve the difficulty of encoding sign language in a linear way.

The first version of HamNoSys (Hamburg Notation System) was defined in 1984; it was developed as a linear phonetic transcription tool for sign languages, this transcription should be possible for all sign languages in the world. The main problem of this system is its difficulty of use, in particular in taking notes or in reading.
SignWriting is developed by Valerie Sutton for the Center of Sutton Movement Writing, in 1974 [9]. It is based on graphical, bi-dimensional representations, using graphical symbols. This system is easy to encode in computers in a linear way, by assigning numeric codes to each special character.

![Figure 1. Transcriptions of word [read] in French sign language (LSF) [5].](image)

### 2.2 Video Based Systems

The systems oriented video consist on encrusting in the initial information, a sequence video corresponding to a human interpreter. In this case, the performances are bound closely to the diagram of coding put in work for the video in sign language. Today, we can offer ourselves many normalized tools, outclassing of very far our predecessors in term of debit/quality. Some present projects based on the video are: “The Personal Communicator” [12], “LSF Lexique” [6]…

To remedy the main problem of these systems oriented video, a first technique consists in coding the plots video in their totality, whereas a second solution consists in coding a selective objects video of arbitrary shapes. Essentially, we have to interest to the hands, face, bust and bottom of the picture for which an automatic procedure of segmentation has been developed. The quality, the integrity and the intelligibility of the sign language content, versus the compressive debit, depends of the following parameters: number of plots in the diagram of coding not of quantification, considered cadence video and resolution of the video.

### 2.3 Avatar based system

In this new technological context, the modeling of a virtual character can be achieved either according to a segmented model, obtained by a hierarchical graph of the anatomical segments 3D, either according to a model seamless. In the two cases, the surfaces are represented with the help of polygonal stitch or by a mathematical analyzing or according to implicit functions to skeleton. The creation of the virtual character is achieved either from a modeler of geometric primitives or with the help of a scanner 3D. In new standards, the approach of segmented virtual character exists in the H\|Anim specifications [4], as well as in those of MPEG-4 FBA (Face & Body Animation) [7], whereas the representation by virtual character is processed in MPEG-4 BBA (Bone-Based Animation). Some projects based on avatar technology are: “Signeuse Virtuelle 3D” [11] “eSign” [3] and “VSigns” [13].

### 2.4 Conclusion

If performances of coding sequences videos in sign language are limited by constraints of low bandwidth of networks and the requisite quality, its main limitations are due to the fact that
video contents are non reusable and therefore a human translator in language of signs is necessary every time we need to make modification. This remains very costly in real applications. These reasons leaded us to be more interested in communication systems in sign language by animation of virtual 3D persons.

3 WebSign

WebSign is a Web application. It is based on the technology of avatar (animation in virtual world). The input of the system is a text in natural language. The output is a real-time and on-line interpretation in sign language. This interpretation is constructed thanks to a dictionary of word and signs. The creation of this dictionary can be made in an incremental way by users who propose signs corresponding to words. A word and its corresponding sign interpretation are added effectively to the dictionary only after its verification by an expert administering the system.

However, contrary to popular belief, sign language is not universal. Wherever communities of deaf people exist, sign languages develop, but as with spoken languages, these vary from region to region. Many sign languages are in use around the world and are at the core of local Deaf cultures [8]. Some sign languages have obtained some form of legal recognition, while others have no status at all.

![Figure 2. Real time interpretation](image1)

![Figure 3. Interface for the construction of signs](image2)

For this reason, we implemented the notion of community. A community is a group of users that can build and share a common dictionary of sign language. A dictionary can be created totally by a specific community or can be just an instance of an existent dictionary where some specific words are interpreted differently to respect the intrinsic specification of the concerned community.
4 A tool for creating course for deaf pupils

Using Websign, we have developed a web tool specialized in creating course for deaf pupils. The course is a group of lessons, in which every lesson is a group of web page containing a variety of images and their correspondent description. Our web tool provides an avatar which plays the sign already translated by Websign.

The use of graphics seems to be an efficient pedagogy method to acquire new vocabulary items, in fact, it still used in traditional education in ordinary schools and in pedagogic games for young children.

The association of images and their descriptions offer the advantages of clarity and simplicity of acquiring information for both the lesson maker and the student.

4.1 User interfaces

Our tool offers two interfaces, one for the teacher and the other for the deaf pupil. The teacher’s interface is constituted mainly by a dedicated authoring tool to create, modify and delete lessons, edit links with different pages and visualize lessons. A lesson can integrate text, images and animations. Animations consist of interpretation of text in Sign Language. Those animations are created by Websign and integrated in the lesson page in order to interpret automatically texts in visual-gestural-spatial language by the use of avatar technology. At the first step of this project, this tool can be used to create basic lessons dedicated to teach mainly words and their associated interpretation in sign language.

The student’s interface offers the possibility to the deaf pupil to consult the text and related images and to see the corresponding interpretation in Sign Language. In fact, every lesson generated by our tool is represented by a certain number of pages, in every page there are a limited number of images with their descriptions in full letter. When the pupil click on an image, the avatar, which is in the left of the page, plays the associated sign. This action can be repeated as many times as the user need to understand or to memorize the description.

Remark that the access to lessons is very simple. Our application is designed for young deaf. The interfaces of this type of application should be very simplified. For this reason, all buttons and links are represented with images and animations related to their sign animation, what allows pupils to explore easily the lessons.

The second interface is used by pupil it’s formed by a group of lesson every lesson represented by a certain number of pages, in every page there are three images with their description in full letter, when he click on image the avatar which is in the left of the page play the sign. This action can be repeated as many times as the user need to understand or to memorize the description.
4.2 Online and offline course

The pupil can use the tool by two different modes: the online mode and the offline mode. In the online mode, when the pupil clicks on the image, the web browser sends a request to Websign server, which sends him back the description of movement corresponding to the sign. The pupil can download the lessons and use it in an offline mode, which corresponds to web pages containing already the images, their description and the description of the movement corresponding to the sign. In such way no communication with Websign server is needed and by the way the pupil has no access to the update we can make on the Websign data base.

When the teacher creates the course, two copies are made. One, for an online mode, does not contain description of the movement which the avatar should play. The other copy is for the offline mode and contains all the description required in the lesson downloaded.
4.3 Getting signs from Websign

In the common protocol, for every request made by the web browser, the result is downloaded in a new web page. Such protocol requires the downloading of the three dimension scene every time a request is made for getting a sign. In fact this alternative is time consuming and its loading in the principal memory is too slow to be used by the system. So we opted to Ajax technology, when we need getting sign which is actually a description for animation of the avatar. The contribution of Ajax technology is the recuperation of result of an http request into a variable, which can be manipulated with a script like JavaScript or VBScript and decoded before being played by the avatar.

5 Conclusion

In this paper, we presented a Web-base tool for generating online courses dedicated for deaf pupils and based mainly on sign language interpretation of texts. Our aim is to distribute this tool on a non-profit basis to educators, students, users, and researchers, and to disseminate a call for contribution to support this project mainly in its exploitation step and to encourage its wide use by different communities. A prototype of this tool is under construction. First results are very promising. When achieved, our aim is to distribute this tool on a non-profit basis to educators, students, users, and researchers, and to disseminate a call for contribution to support this project and to encourage its wide use by different communities.

References:


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