

INTERACTIVE APPLICATION IN SPANISH SIGN LANGUAGE FOR A PUBLIC TRANSPORT ENVIRONMENT

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ABSTRACT

People with hearing disability find it difficult to access to information and communication in public places. According to this fact, it is considered the possibility to design a communication system based on the Spanish Sign Language (SSL), which helps to overcome this barrier in public environments of wide concurrence, where much of the information is provided to users through oral communication. Therefore, we want to provide a channel of communication that will help to improve the integration and independence of this group and contribute to the Universal Accessibility referred in the International Convention on the Rights of Persons with Disabilities.

With this objective to alleviate the problem of communication and facilitate access to information, we propose an alternative communication system to "Public Address System, PA" used in the public areas of wide concurrence, based on the translation of oral messages to the SSL, using interpreter a lively 2-dimensional (2D) character.

For the development of this research, an airport has been chosen, due to the large volume of users that travel daily, availability of audiovisual infrastructure and facility to capture messages to translate.

The videos obtained in 2D, for each message translated into SSL, have been subjected to a validation process by members of an association of hearing disabled, who have contributed their opinions and suggestions for improvement, which have been applied to the final multimedia application.

KEYWORDS

Hearing disability, sign language, interactive application, animation, rotoscoping.

1. INTRODUCTION

Within the group of people with hearing disability, many of them use as the first, and in some cases as the sole mode of communication, sign language. The purpose of this work is to facilitate access to information in environments where audible warning (warning messages, including emergency messages), is essential for orientation and adaptation. The intention is to contribute to the independence and integration of these people into society, improving their quality of life and compliance with the "Universal Accessibility for people with disabilities."

In the case of persons suffering from hearing disability, it is necessary to place at their disposal all the available resources for access to information, "the knowledge and autonomous learning, without which the information technology and communication, which can be an opportunity, become a new barrier." (Utray Delgado & Ruiz, 2011). Example of this is at airports, where messages considered of general interest to users, do not reach everyone equally. Some people with hearing disability find it difficult and, in many cases impossible, to receive those messages. In this sense, in recent years there have been many improvements at airports, introducing specialized personnel at points of information or installing induction loops to provide a much clearer audible information for everyone using hearing aid or cochlear implant. However, these interventions are not completely solving the communication problems encountered by people using only sign language as a communication medium.

As is well known, "there is no universal sign language" (Ortiz, 2005). Each country has its own sign language. Even within each Spanish community there are versions of the language. Due to this circumstance, to carry out the application posed, the Spanish sign language has been chosen, declared as official language in Law 27/2007 of 23 October (BOE. 255), by which Spanish sign language are recognized and regulate the support means for oral communication of deaf people, with hearing disability and deaf blind. Variations between the sign languages of the different Spanish regions are not very pronounced, except in Catalonia.

The public places that may be subject to an action such as that posed include, among others: airports, ports, train stations and subway, all kinds of sports facilities, shopping centers and other public facility where information is transmitted to users through voice communication. In these places, the information provided by PA system, screens and posters may be insufficient to enable such people to cope with complete independence as, in addition to not listen to the messages offered by PA system, may have difficulty reading written texts. However, it is possible that they can recognize the messages transmitted in sign language.

Once the various possible scenarios are established, an airport has been chosen for the development of this application, due to the ease of capturing messages of PA system, high user concurrency and disposition of large spaces where screens can be placed for the issuance of the videos in sign language.

There are other means of disseminating information, which are increasingly in demand such as interactive screens by mobile applications or tablet, via WI-FI.

2. OBJECTIVES

The objective of this work consist to make a multimedia application to translate messages advertisements and notices issued by PA system and information boards to SSL, through an animated character or avatar, in two dimensions (2D). This intervention will allow deaf people to access information with greater autonomy.

The issuance of these animations can be made by two ways. On the one hand, an unidirectional diffusion consisting of storing animations on a server and every so often projected on the screens located on the premises for this service, while messages are sent over the PA system. On the other hand, an interactive application that allows access to information on flights status in terminals, distributed throughout the enclosure. In addition, these devices will emit videos with the information disseminated by PA system sequentially to a screensaver, and can be interrupted at one point, said automatic issuance by a user to query information about the status of a flight of interest.

Consequently, this intervention is to take a further step towards the integration of persons with hearing disability, trying regardless of the degree of it, either partially or totally, that they can move into a better environment adapted to disability, following the signs and messages presented through projections of short videos in sign language accompanied by subtitles.

3. METHODOLOGY

The performance of this audiovisual application is structured in different phases, which have direct and sequential relationship between them: capture of messages, message translation to sign language, character design and conversion of video messages captured in 2D animation, implementation of an interactive graphical environment for the selection of messages and validation of videos.

3.1 Capture of Messages

The types of hearing messages sent in these facilities are diverse. It can be heard recommendations on the use of facilities, notices or rules established in the enclosure, in addition to information on the status of flights. Information regarding the status of flights can also be found on monitors distributed throughout the enclosure.

In Spanish airports, managed by the company AENA, messaging is standardized. In this work has been chosen Gran Canaria airport for the selection and recording of audio and visual messages. The uptake of the messages has been collected in two different ways: Through audio recordings on the airport enclosure and through written information posters distributed by the airport.

3.2 Translation of Messages to Sign Language

The next step for the realization of the application was to translate the advertisement and notices and / or written to the SSL. To carry out this phase of the work it is necessary to have a SSL interpreter responsible for this task.

In the flight number selection messages, included in the notices messages section, small changes will be made by reducing the number of digits from six to three, to get a better operability. This allows a more agile and entertaining presentation of the resulting application.

3.3 Character Design and Conversion of Video Messages Captured in 2D Animation

Currently there are many programs for creating vector animations very easily, offering all kinds of tools from the most basic to others that require more skill to use, some require licensing fees, while others are completely free, although these generally do not have the same benefits. Depending on the level of animation you want to achieve, it should be chosen the one that best suits the requirements of the final product.

At this phase an analysis of the main tools available today was made in the field of computer animation, both professional and amateur. The most common vector animation programs where differences can be two types, free open source, like Ajax Animator, KToon, Pencil or Synfig, and the ones which have to be payed, such as Adobe Flash, Adobe AfterEffects, Anime Studio or Toon Boom, among others.

After analyzing the different software options and the study of their characteristics, it was assessed what was more adapted to the needs and defendants technical requirements, choosing the specific animation software known as Adobe Flash CS5, which is an application in the form of study working on "frames" and is intended for the production and delivery of interactive content. It uses both vector graphics and raster images (raster image or bitmap), sound, program code, video streaming and bidirectional audio. Additionally, this program incorporates animation technique called rotoscoping. The advantage of the rotoscoping technique is that it replaces people's faces, which may be more or less attractive, for an animated character. By using this technique, the animation vectors were obtained. With these animations and the incorporation of some of the elements of the scene, like the stage and wallpaper, it has been achieved the final videos in SSL, where the performer becomes an animated character or avatar. Using an avatar is justified by the omission of the identity of the performer, it "depersonalizes" him, therefore produces a neutral perception of the message.

3.4 An Interactive Graphical Environment for the Selection of Messages

The next phase of work involves the creation of multimedia applications, that the user can select each video in SSL. It aims to design a friendly environment that captures the attention of users with interactive applications that allow users to interact with items on the screen, such as buttons or text windows. These will enter the desired orders by peripherals, which allow to control such interfaces to obtain the requested information. The software used for the programming of such applications has been the "ActionScript 3.0", which is the native programming language of Flash.

According to the objectives, they will be performed by two multimedia applications, which are discussed below.

3.4.1 Application 1: Simulation destined to Video Channel

From the previous videos, and through appropriate programming, it will be performed a unidirectional diffusion, storing animations in a server and each time a message is issued by PA system, simultaneously the corresponding video is displayed in SSL on screens distributed on site.

3.4.2 Application 2: Simulation of Interactive Application to Query Flight in Electronic Devices

This application has been designed an interactive query system, where the user can check the status of his flight by entering the code on an electronic device, which has a keyboard and monitor on which information is presented in SSL the state in which it is located. During the time in which no information is requested, on the device's screen will be displayed a screensaver with messages in SSL made for first application. They will follow a set pattern of visualization, which will abort only when a user interacts with the device. At this point the user is asked to enter flight details he wants to view, to display the information on screen. If after a set time it is not interacted with the device, it returns to the screensaver.

3.5 Validation of the Videos

After obtaining a first version of the product, it has been subjected to a validation process as a useful tool of communication for people with hearing disability. For this, it has been designed a questionnaire with several sections that assess technical, aesthetic and intelligibility aspects in communication in SSL. In addition, a final section in which an assessment of the application, suggestions and proposals for improvement is sought is included.

Among the videos to validate, four advertisements and four notices messages were chosen. In these videos, subtitles and audio were deleted, not to offer any clues about those messages to those who could read texts and / or have auditory perception.

For validation of the videos on SSL, we have been in contact with the Deaf People Association of Gran Canaria, who supported us to conduct this phase of the work. From their suggestions, in order to get as many samples as possible and have the support of a sign language interpreter to help us communicate with the audience, it was made to coincide with the presentation of videos and recollection of surveys, with the completion of an event at the headquarters of this Association.

For the test, it was arranged a room suitable for the purpose. At the beginning of the meeting, the attendees were explained the content and objectives of the development work that was to be submitted, with the help of interpreter of SSL. Then we proceeded to display videos related with the advertisements in a 42-inch LCD monitor, ready for the occasion. Then the questionnaires on these videos were passed to all present. Subsequently, the same process was followed with videos concerning notices and related surveys.

In viewing the videos and conducting surveys, thirteen people participated, nine were women and four men, all aged between nineteen and sixty five years.

To obtain a detailed study of the results, they were analyzed from three different aspects: the collective total responses, responses by sex workers and finally, a third analysis separating the responses by age.

4. RESULTS

From the methodology discussed, were the results obtained discussed below.

Four advertisements and four notices messages were chosen. It was considered that this amount is sufficient to obtain an objective assessment of the level of acceptance of this work.

Independent videos were recorded for each of the messages translated to SSL. These videos will be used later to make 2D animations to be included in interactive applications. The avatar obtained and the process of converting the images of each video to 2D animation is shown in Figure 1. The process is repeated for the remaining frames of each video.

In the development of the videos, it has been cared formal aspects like colors fund scene, the character, the speed of the gestures, the subtitling or symbols, among others, with the goal of capturing the user's attention.

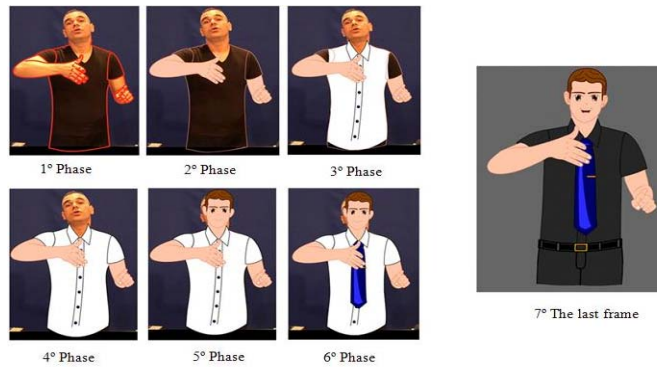


Figure 1. Changes in a single frame, during the animation process

The results obtained to the first application are shown in Figures 2, 3 and 4. Figure 2 shows the first screen for the main menu, which the user finds when accessing this application. There, has been inserted a background image composed of a scenario that is acquainted with the airport environment. For its composition, it was used the characters and the logo, taken from a photograph taken outside the enclosure, plus the addition of two buttons with the name of their function, which when clicked allows access to the submenu.

When the folder shaped button on the top with an icon showing an exclamation mark is pressed, it redirects us to the scene of the advertisement menu, shown in Figure 3.1, where you can choose one of the four videos available by pressing the corresponding button. In this section we find six buttons, four for displaying the advertisements and two smaller ones, of which one has the function to move the scene of notices and the other one returns us to the main screen.



Figure 2. Display MAIN



Figure 3. Playing a video advertisements menu



Figure 4. Playing a video obtained from submenus

When selecting the screen shown in Figure 2, the button located on the bottom of the main menu, sends us to the scene menu notices shown in Figure 4, where you can select messages with information regarding to flight status. In this section we find eight buttons, five of which have special behavior, because they contain submenus.

The buttons of these submenus are responsible for selecting the combination of videos you want to display. We talked about combining videos and not watching a video, because at this stage you have to do a combination of five of them to obtain the final video to be played. This is because in each submenu you have to select a message: initial message, each of the digits of the flight and final message. Within each submenu there are different videos, as many as messages we can choose in it. In the submenu flight code, the virtual keyboard that opens when you click on each of the three buttons shown, all the letters of these submenus are associated with their corresponding video of the alphabet and numbers.

Once you have selected the corresponding digit on the flight, and have chosen the option of flight status, we will have available the "play" button to play the message indicating, in sign language, flight status with the typed code, such as shown in Figure 4.

For "Application 2: Simulation of interactive application for flight query in electronic devices " has designed the screensaver system shown in Figure 4, which the user encounters when accessing this application. All scenes are formed under one animation pattern and is made of two elements. Initially it is displayed the back of the stage and an animation that is shown as a text that scrolls across the screen from right to left showing the message : "PRESS ANY KEY TO ENTER YOUR FLIGHT NUMBER." With it, it is intended that the user should be aware that act on the keyboard to get the information you want. When you finish the text displayed on the monitor, it starts playing one of the videos that have been animated before.

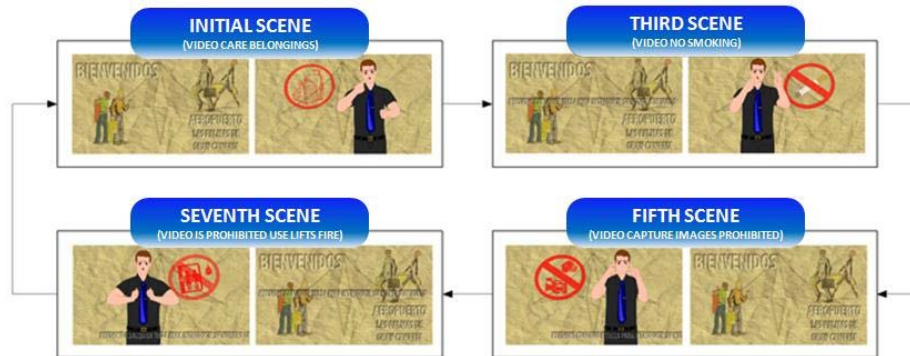


Figure 5. Scenes and videos that make up the screen saver

We have added new elements to these videos and that belong to the symbols of the folders in the first application. To display on this application, it was decided to change the scale and color, choosing in this case red. They have also been provided with a small animation, creating a flashing effect. This is to reinforce, in a subtle way, the information that is being offered to the user.

When a user interacts with the device, he will be shown a screen on their requested flight code. After entering this code, the corresponding video on the state of the same is shown, but in the event that the flight number is entered wrongly, dynamic text is activated in the center of the screen with the following message: "THE FLIGHT NUMBER MARKED IS NOT AVAILABLE."

For this application to work properly it is necessary that the interactive device has updated information on identification data and flight status, the same way that the information provided by other means such as information screens and PA system is renewed. It is necessary that the information in all media is simultaneously updated. This task can be performed automatically by connecting the device to the corresponding database or manually, in which an operator is responsible for updating this information.

Once the results shown for both applications, the results of the evaluations obtained through surveys are presented.

In relation to the compression of the videos, it can be seen that about half of the attendees suggests they can be improved. The results for questions related to the compression of the videos, are shown in Figure 6.

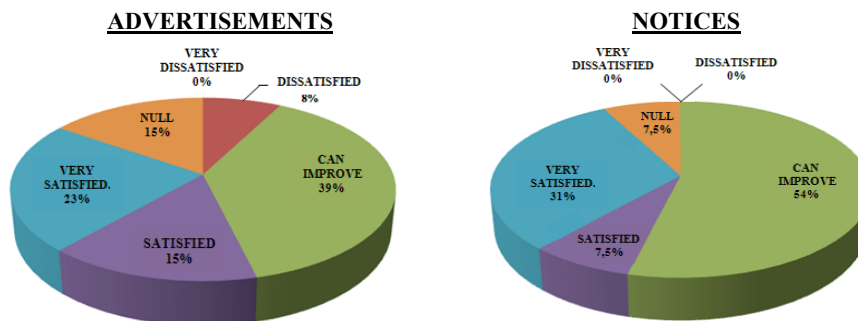


Figure 6. Level of satisfaction with the videos shown

Regarding the use of a character or avatar in 2D, 84% of attendees were in favor. If we analyze by gender, we see that every men and 76% of women liked the video presented with a 2D character as an interpreter of SSL. In the results we see that all ages prefer 2D animation, but in the age group of between twenty and thirty-five, the acceptance level decreases. Of the three members of this group, each have a different opinion to the use of an animated character.

Regarding the use of subtitles in the videos, 73% of the participants are in favor of its use. In the analysis of the responses to this question by gender, we see that the vast majority of both sexes considered appropriate to include subtitles to the videos that have been shown to them. In the study based on the responses of different age, the same general trend of preference subtitles in the videos is perceived. However, it should be pointed out that 50% of the people in the age range of forty-six to sixty have failed to answer this question.

Finally, an assessment is requested for the videos displayed on a scale of 1 to 10, obtaining the results shown in the following table.

Table 1. Overall rating of the videos shown

GLOBAL ASSESSMENT OF VIDEOS ON SSL				
Rated	Advertisements		Notices	
	Result	Percentage	Result	Percentage
1...4	0	0%	0	0%
5	1	8%	2	15%
6	2	15%	0	0%
7	1	8%	0	0%
8	1	8%	2	15%
9	1	8%	1	8%
10	7	54%	8	62%
NULL	0	0%	0	0%
SIGNS	13	100%	13	100%

5. CONCLUSIONS

This article has presented a multimedia product development that can extend the possibilities of communication in public places with people who use the Spanish sign language. This communication system can be particularly useful to provide people with hearing disability an avenue of further communication, contributing to an increase in personal autonomy. It also has the advantage that this model can be exported to any public setting where required, to convey information to users.

The environment object to the simulated study was an airport. The results show that an application of this characteristics and minimal cost can provide a broader communication service based sector of the population who may have difficulty accessing messaging and sound alerts. In this regard, it is particularly interesting that no additional infrastructure is required to present at sites of public assembly.

In addition, it has been shown that a similar submitted development provides the ability to offer users a friendly multimedia simulation, placed in strategic places for information points, with the aim of expanding the communication channels available to inform passengers' flight status and other information that may be of interest.

In particular, the use of the technique of rotoscoping to create the avatar appears to provide a valid and depersonalized approach to sign language translation using a human figure.

Although the number of samples in the validation survey is small and it is necessary, therefore, a larger study, we can conclude that the majority of user perception is positive, although messages can be improved. In this sense, our hypothesis is corroborated, in which we proposed that it should be added subtitled messages to the videos, thereby achieving a more complete communication. The validation results also indicate the desirability of improving the character animation, especially in his body language.

This work is a pilot test to assess the use of rotoscoping and animation technique to create a communicative environment improvement for the hearing disability. This model and workflow allows the extension of the results to the official sign languages of other countries and environments. Additionally, it can be used other devices that allow the reception of messages such as tablets and mobile phones.

The experience obtained in this work can be transferred to other fields such as education, in which has utility as an augmentative communication system for hearing disability people. In this sense, it may be interesting to incorporate a virtual interpreter in the class that repeat the oral explanation of the teacher, in sign language.

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