CSCW as Accessibility Tool

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Abstract: - Universal accessibility has recently become not only a legal requirement but also a moral obligation. Every day, an increasing number of resources are available on the Internet and many of them are not accessible to all users. The conversion process to make a resource accessible is costly in terms of time and effort, and does not always result economically viable. Methods stemming from Computer-Assisted Cooperative Work (CSCW) can be applied to achieve audiovisual accessibility, and exploit the novel initiatives represented in the new social networks and what has been termed Web 2.0. The current work proposes the definition of a reference architecture which uses Cooperative Work techniques, with the objective of converting multimedia resources into accessible resources at a greater speed and with less effort.

Key-Words: - Accessibility, CSCW, closed caption, audio description, multimedia

1 Introduction

The volume of repositories of multimedia resources on the Web has increased prolifically in the last number of years. Websites such as YouTube or Flickr manage millions of videos and images which are uploaded by their authors, generally every-day users, and in some cases, organizations. However, these resources suffer from a defect which in today’s information society has become fundamental: accessibility.

Accessibility applied to audiovisual resources enables users with an auditory or visual disability to avail of alternatives for access to information in an environment equal to that of standard users. The alternatives for achieving accessible multimedia resources vary based on the characteristics of the resources [1]. The requirements for converting an image into an accessible image are not the same as the requirements necessary for making an audio file accessible. Each typology of multimedia resources has one or more associated solutions for converting the resources into being accessible, as is demonstrated below in Table 1.

<table>
<thead>
<tr>
<th>Components affected by accessibility</th>
<th>Access with audio description</th>
<th>Access with caption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Image</td>
<td>Alternative text</td>
<td>Alternative text, use of clear and simple language</td>
</tr>
<tr>
<td>Text</td>
<td>Audio</td>
<td>Use of clear and simple language</td>
</tr>
<tr>
<td>Audio</td>
<td>Audio</td>
<td>Caption</td>
</tr>
<tr>
<td>Video</td>
<td>Audio description</td>
<td>Caption</td>
</tr>
</tbody>
</table>

Table 1. Accessibility Alternatives

The process of converting resources into accessible is costly. It requires the realization of one or more additional tasks, which depending on the multimedia resource in question, can be rather extensive tasks. For example, in the case of audio description, it is necessary to determine whether the resource is suitable to be audio described, draft a script, revise the script, correct it, realize the editing and narration of the resource (usually in video format), and revise it. This is a series of steps which require a quantity of effort and time proportional to the duration and complexity of the resource. Given that it is generally the end users who publish multimedia resources on the Web in a spontaneous fashion, it is habitual that they do not consider taking the effort to make them accessible. This implies the outcome that many groups of society inevitably cannot access such resources.

The conversion of multimedia resources into accessible resources is realized by means of various processes. These processes could be realized efficiently by a set of different users. This does not imply a reduction in the total effort required, however, a decrease in individual effort. Computer-Assisted Cooperative Work, or CSCW (particularly in Web 2.0) provides an opportunity for the conversion process, distributing the effort between various individuals, which entails both a reduction in conversion time as well as an increase in the number of accessible multimedia resources published.

This work proposes a CSCW architecture for the conversion of multimedia resources into
accessible. In order to achieve this objective, the work involved a study of the phases in the conversion process, determining what is the correct order for executing the various tasks and which tasks have the possibility to be carried out in parallel. With this information, applying established methods which have demonstrated their efficiency in CSCW, the requirements and conceptual architecture will be described at a high level.

### Audiovisual Accessibility in CSCW environments

The principal techniques used to make audiovisual resources accessible are subtitling and audio description. Subtitling is defined as “a communication support service which shows the oral discourse, suprasegmental information, and sound effects produced in any audiovisual resource on the screen by means of text and graphics” [2]. Audio description is defined as “a communication support service which consists of applying a set of techniques and skills, with the objective of compensating for the lack of processing of visual content in any type of message, submitting adequate oral information which translates or explains it, in such a way that the disabled viewer perceives the same message as similarly as possible to a person with sight” [3].

The processes of subtitling and audio description are not archaic. There are regulations at both national and international level, as well as reference guides published by associations, bodies or private institutions and companies which specify what the processes consist of and how they should be realized [4][3][5][6][7].

Audio description process requires the realization of a determined number of tasks: generation of time codes, creation of the audio description script, expression of the contents and titles of the production, recording of the oral expressions, addition of sounds (whose process includes the insertion of the narration in the sound track of the production, joining the oral expressions and the sound track, and the master copy) [3]. These tasks are realized by specific roles which have concrete tasks assigned to them: the analyst, who determines if the work is appropriate, the audio descriptor, who drafts the script, the narrator, who realizes the narration in the presence of the images; the film editor, who mixes image and voice, comparing volumes; and the reviser, who revises the whole set. These tasks and profiles should be supported by the audio description system and are the base for the defining of this system. Table 2 displays the activities necessary for the realization of the audio description task according to the AENOR norm previously described.

In a parallel way, subtitling is a known process and defined as being formed by a series of activities which are executed sequentially. The regulation in relation to subtitling makes reference to technical aspects which refer to, for example, how and where the subtitles should appear and how they should be drafted, however, it does not make reference to how to carry out the subtitling process. This is in contrast to audio description, where this aspect is clearly described. The activities are analogous except for the aspects in relation to the narration and sound, which are substituted by the insertion of subtitles in defined time segments.

<table>
<thead>
<tr>
<th>Users</th>
<th>Activity</th>
<th>Rol</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>Set resources to perform audio description</td>
<td>Analyst</td>
</tr>
<tr>
<td>Group</td>
<td>Time codes generation</td>
<td>Audio descriptor</td>
</tr>
<tr>
<td>Group</td>
<td>Script generation</td>
<td>Audio descriptor</td>
</tr>
<tr>
<td>Group</td>
<td>Script revision</td>
<td>Revisor</td>
</tr>
<tr>
<td>One</td>
<td>Locucion</td>
<td>Announcer</td>
</tr>
<tr>
<td>One</td>
<td>Audio edition</td>
<td>Editor</td>
</tr>
</tbody>
</table>

Table 2. Audio description activities

The definition of these two processes demonstrates the grade of user participation permitted in each of the activities, divided into two types; single user or multiple users, as well as the profile which is required to be developed. Obviously the division of tasks generates intrinsic problems for CSCW systems, related to the sharing of information, communication and coordination [8][9]. This has a series of implications at the moment of defining a CSCW architecture, such as resolving coordination and collaboration issues [10], negotiation and discrepancies among the members of the work group [11], member control [12] or the control of work flows [13].

Besides what has been previously described, it should be mentioned that the motivation for the current work has been based on the extension of the cooperative concept entitled Web 2.0. However, realizing subtitling or audio description in a cooperative way, which is the result of the formation of an uncontrolled group of users, implies a new set of problems which must be resolved. The reliability of the participants during the conversion process is the most obvious problem. This is particularly because the conversion is not performed in an obligatory fashion by professionals in the field. This provokes the requirement to dispose of mechanisms
which guarantee the quality of the work, and avoid inconsistencies, even if they are the result of voluntary actions or accidental.

The architecture proposed in this work has to comply with all of the requirements from the point of view of accessibility and the subtitling and audio description of the resources, as well as deal with intrinsic problems of CSCW environments.

The objectives or challenges faced by the architecture, are, in summary, the following: permit the conversion process of multimedia resources into accessible, in a cooperative manner; manage the sharing of tasks, avoid the emergence of conflicts as a result of concurrent Access to information, and control the work flow; and obtain a reasonable grade of reliability of the work in an uncontrolled work environment.

**Cooperative Audio Description**

Given the analogy between the subtitling and audio description processes, audio description will be used as an example. Only audio description can demonstrate the solution proposed, as it will be similar to that for subtitling, containing essentially the same concepts.

As shown in Table 2, based on a single multimedia resource, there is a series of activities to realize to convert it into accessible by means of audio description, which has the following characteristics: the activities should be realized in a sequential manner; each activity will be realized for a determined role; each activity can be divided, and each division realized in parallel by various users. Thus, the existence of a task work flow is required which manages the correct realization of the activities.

The CSCW system capable of giving support to the conversion into accessible of multimedia resources is comprised of the following repositories and process models (Figure 1):

- **Multimedia Resources Repository.** This repository contains the multimedia resources, whether they are accessible or not. It also contains the elements which are complementary to accessibility; the information which converts a multimedia resource into accessible, including the corresponding support information necessary for its use. In the case of the example, the audio description is considered as the complementary element, including the narration as well as the temporal segments in which it should be reproduced.
- **Users Repository.** The repository of users maintains the information of the users “actors” (those who realize the tasks for making the resource accessible). Each user will be associated with one or more roles for each of the processes supported. In the case of the example, the process is the audio description. Each process role of the user has a value, obtained from outside users or “spectators” (those who can access the accessible resources). The assignment of values is the evaluation process which enables the assignment of an acceptable reliability value with reference to the actual accessibility of the resources.

- **Workflow Database.** This repository is responsible for providing physical support to the information related to the control of the conversion process of each of the resources. Each multimedia resource should be in a determined state, which implies the possibility to realize a determined activity of the conversion process from the process which makes the resource accessible. It should control the assignment of activities to users to avoid duplications or redundancy in the completion of tasks.
- **Workflow Engine.** This functional model is responsible for managing the correct realization of the conversion process. It is comprised of two subsystems:
  - **Task Planning System.** Responsible for, based on the information contained in the Workflow Database, permit or deny the realization of activities. It controls the change in state of the resources, determining when the next activity can be commenced.
  - **Concurrency Control System.** System responsible for avoiding audience-related problems. Its basic functionality consists of avoiding the assignment of one activity to distinct users.
- **Reliability Role Support.** Module responsible for establishing the control of the reliability of the process of making the resources accessible. It is comprised of two subsystems:
  - **Reliability Assignment Support.** System which will give support to the “audience” users to allow them to determine the reliability of the work. The reliability of the work should be assigned based on the reliability of its activities, which indirectly represents a ranking of the “actor” users, or those who have carried out the task.
  - **Reliability Control Engine.** The functionality of this system, consists of, based on the reliability assigned by the “audience” users, assigning the grade of reliability of the “actor” users, determining the reliability of a production, allowing or prohibit the “actor” users to carry out a particular role, or establish a revision strategy in the case of diffused information.
Multimedia Accessibility Process. This module is used specifically in the context of audiovisual accessibility and will only be described briefly. It should allow the realization of all of the tasks involved in making a resource accessible.

- Time Segments Indicator Tool. Tool for the marking of time segments.
- Script Editor. Allows the drafting of the script, placing it in its corresponding time segments.
- Audio Editor. Allows the narrator to narrate the script.
- Audio Manager. Provides the tools for the addition of audio to the resource, placing the narration in the corresponding time segments, also allowing adjustment of volume.
- Control Tools. One of the phases of the process of conversion into accessible should be supervised, as well as the entire production. The architecture contains control tools to realize this supervision.

Conclusions

Unfortunately, the Internet is full of not accessible multimedia resources produced by the Web’s own users, commercial companies or even institutions. The reasons for this reality are various; ignorance, unprofitability, lack of adequate tools, or simply lack of knowledge. All of this provokes exclusion in society which should be eliminated. Permitting access to information in equal conditions to all users, regardless of whether they have a disability, is a legal and moral obligation.

One of the principal values of cooperative environments is the work effort they contribute. Web 2.0 takes this effort one step further; it is the proof that the CSCW paradigm can be successfully applied to groups of uncontrolled users to achieve a common end, even in an altruist manner. It is an opportunity to avail of the technology characteristic of cooperative environments and the active participation of the users of Web 2.0 to eliminate social barriers.

This article has proposed the first steps in the definition of a cooperative system to convert multimedia resources into accessible by uncontrolled user groups. The requirements have been identified from the point of view of conversion and from the perspective of the realization of the process in a cooperative way. Based on an analysis of previous research and studies, the problems which cooperative environments entail and should be taken into account have been discussed. It should be noted that the definition of all of the processes has been determined based on accepted norms and processes, to organize some processes which are currently not being carried out in a standard way. Currently, as a continuation of the present study, exhaustive definitions are being formulated of all of the modules and subsystems, to be able to implement a reference implementation in the future and accurately evaluate the precision and efficiency of the proposed architecture. Undoubtedly, it can be affirmed that there are solutions to the problems presented in this paper, and that the requirements with which the proposed architecture should comply have been detected and taken into account.

References


