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Contenidos

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Captura de requisitos para el diseño de un chat accesible

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Resumen

El uso de dispositivos móviles (DM) forma parte de nuestra vida diaria. Las personas están acostumbradas a usar los DMs frecuentemente para comunicarse y colaborar con amigos o compañeros de trabajo utilizándolos como herramientas colaborativas. Este artículo está centrado en el uso de esta tecnología en entornos de aprendizaje colaborativo asistido por ordenador o Computer Supported Collaborative Learning (CSCL) para DMs. En la actualidad, existen diferentes herramientas de apoyo al CSCL como: blogs, wikis o chats. Sin embargo, muchas de estas herramientas de aprendizaje utilizadas en dichos entornos presentan barreras de accesibilidad que impiden que gran cantidad de personas no puedan utilizar estas herramientas. El principal objetivo de este trabajo es analizar cómo diseñar de forma accesible una herramienta colaborativa de aprendizaje síncrona para DMs. Se presenta como propuesta un conjunto de requisitos, a tener en cuenta en el diseño de un chat accesible, obtenidos siguiendo un enfoque de Diseño Centrado en el Usuario (DCU). Son el resultado de una captura de requisitos a través del uso de técnicas como Perfiles de Usuarios, Personas y Escenarios.

Palabras clave: m-learning, CSCL, accesibilidad, chat, síncrono.

Requirements elicitation for designing an accessible chat

Abstract

The use of Mobile Devices (MD) is part of our diary life. People are used to use the MDs almost every day to communicate and collaborate with friends or colleagues in different environments such as work or education among others. This paper is focused on the use of this technology for collaborative learning contexts or Computer Supported Collaborative Learning (CSCL) environments. There are different tools which support CSCL like blogs, wikis or chats. However, most of the CSCL tools used present accessibility barriers which provoke that many people cannot use these useful learning tools. In concrete, this paper is focused on eliciting requirements for the design of an accessible chat as a synchronous CSCL tool for MDs in an accessible way. To achieve it, some guidelines and standards are considered as a reference to determine the requirements that a chat should have to be accessible. Moreover, the Scenario and Personas techniques are used to elicit the requirements from the point of view of users and using a User Centered Design (UCD) approach.

Key words: m-learning, CSCL, accessibility, chat, synchronous.

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1. Introduction

Nowadays, Mobile Devices (MDs) are used by everybody regardless of its social level, disability or country. There are many developing countries in which poor people have a MD, even if they do not have money to eat [1]. So, the use of MDs in learning environments can be a solution to reduce the gap and barriers that people have to face when they want to learn and they do not have enough resources [2]. Several laws in many countries try to solve these barriers protecting the students' rights like: DDA[3], LOE [4] or IDEA[5].

On the other hand, it is necessary to remark the importance of collaboration in learning environments [6]. Communication techniques are becoming nowadays powerful tools in Computer Supported Collaborative Learning (CSCL) environments. Due to it, collaboration is up-to-date because people are joined to environments like social networks or blogs where people collaborate with each other to share information and knowledge.

Previous researchers have shown the usefulness of MDs in CSCL environments (m-CSCL)[7]; however, many accessibility problems affect to: people with disabilities; users that use it in environments which limit users' capacities like hands-free or noisy environments; users without experience and so on [8].

Therefore, this study is focused on eliciting requirements for accessible chats in MDs from the point of view of user experiences.

This paper is structured as follows: the second section presents the state of art of m-CSCLs and their accessibility problems; next, the third section presents the requirements needed for accessible chats in MDs; finally, conclusion and future work are exposed.

2. Background

This section introduces m-CSCLSs and the accessibility problems that people have to face when they use them.

2.1. Collaborative Learning in Mobile Devices

Nowadays, MDs are used to support individual and collaborative learning. In concrete, the use of m-CSCL can be an important issue because students are able to study and collaborate with each other [9].

There are some projects that integrate m-CSCLs. For instance, the study provided by[10] implements it with primary school children. Another example is the project implemented in the Arizona University, which uses MDs to support a student group project. As a result, the students were able to improve their oral and written skills among other capabilities [11].

Moreover, due to the importance that MDs are taking in this environment, many learning content management systems (LCMSs) like Moodle[1] or Blackboard[2] have added mobile learning (m-learning) environments as a complement to their e-learning systems. Besides, these tools provide CSCL features like: chats, wikis, blogs and so on which allow students to collaborate with each other through their MDs.

2.2. Accessibility Problems in Collaborative Learning

Many users have to face difficulties when accessing and using current CSCL tools. Some typical accessibility barriers that are presented today in many CSCL tools are that the main information is not accessible through keyboard [12].

Particularly, regarding to the accessibility of synchronous communication tools, people usually find accessibility barriers when using some advanced functionalities of the tool or with the use of the MD's keyboard [13].

Specifically, the communication tool studied in this paper (the chat) usually presents problems of accessibility due to developers do not use the technology in an efficient way. For example, chats are created in Flash or Javascript or developers do not follow accessibility guidelines [14]. However, the main problem is related to follow the flow and rhythm of the communication. For instance, the convert of text-to-speech or speech-to-text in real time is complex depending on the velocity of writing of the emitter. Besides if one of the emitters is not able to write quickly, the other emitter will be bored or not able to follow the conversation [15]. Moreover, some chats do not provide support for text-to-speech or text-to-braille and use hierarchy navigation [12].

There are some previous works related to accessibility in this kind of tools. An example is AMobile, it is an online accessible m-CSCL [16] which main objective is to stimulate students to learn while collaborate with other colleagues. Specially, it provides a special attention for visually impaired students to allow them to use this tool through a vocal interface. Besides, one of the modules that this tool provides is the chat as a

[1] See http://moodle.org/ (29 April 2012)
[2] See http://www.blackboard.com (29 April 2012)

synchronous tool. Moreover, there are some previous chats approximations like Ichat[3] or Achat[4] which are centered in solving the accessibility problems related to technological aspects. Specifically, in MDs AssistiveChat[5] provides new features for people with speech disabilities. However, they are not centered in the main problems of interaction that users have to face when they use chats. Considering all these things, the main goal of this study is to elicit the requirements needed to solve these accessibility problems of interaction.

3. Theoretical Approach

The approach proposed explains how has been elicited the essential requirements needed to design an accessible synchronous and m-CSCL tool. In concrete, the selected m-CSCL tool for this paper is the Chat. Thus, the study is based on standards, guidelines, methods and techniques used to capture the requirements needed to make frequently accessible used mobile chats.

The structure of the proposal is divided as follows. Firstly, it represents the context of the proposal in a mobile Learning Management System (m-LMS). Secondly, the guidelines and standards needed to create a synchronous m-CSCL module are selected. Finally, the m-CSCL module chat is selected and the requirements needed to the design of an accessible chat are explained.

3.1 Context in a LMS environment

A LMS should have different modules which are needed to support a course. This study is based on the Jin's framework [17] which specifies different modules for a mobile LMS. A collaborative module is added to this framework [18], which is considered an important module in learning environments nowadays. There are different authors who specify the main components of a CSCL module [19][20][21] . This study is based on the IMS [21] specification which specifies how the CSCL tools should be to be accessible. In concrete, this specification identifies the requirements needed to create the synchronous tools (chat, audio-conferencing, video-conferencing, whiteboard, Multiuser domain object oriented environments) in an accessible way.

The figure 1 shows a structure of the Jin's business logic layer of a mobile LMS, the inclusion of a collaborative module and the synchronous tools specified by IMS.

[3] See http://www.apple.com/es/macosx/apps/all.html (29 April 2012)
[4] See http://atutor.ca/achat/ . (29 April 2012)
[5] See http://www.assistiveapps.com/ (29 April 2012)

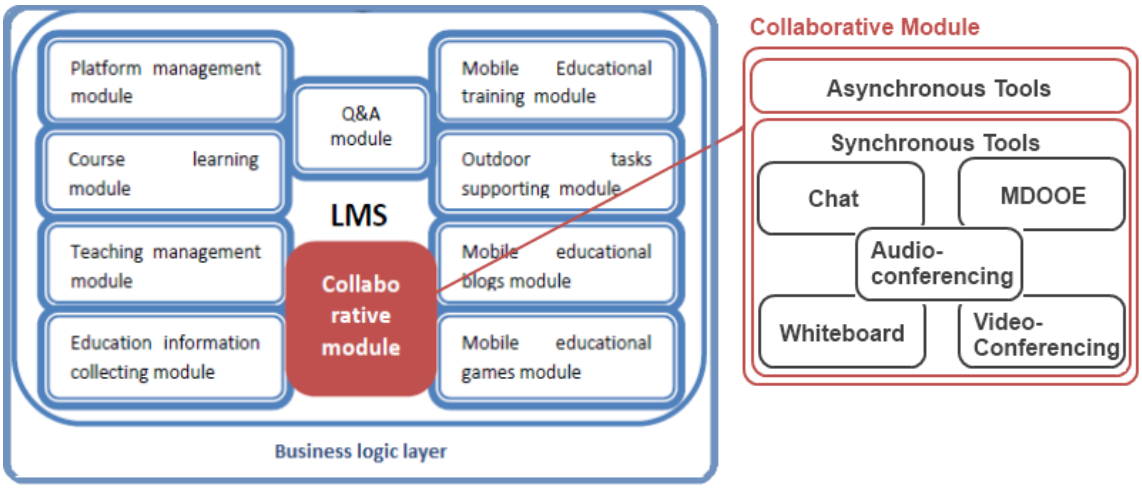

Figura 1. Context of Collaborative Module and its Asynchronous and Synchronous Tools.

3.2 Standards and Guidelines

The main objective of this study is to elicit the essential requirements needed to design an accessible chat for everybody. To achieve it, our research work is based on the standards and guidelines showed in figure 2.

Regarding to accessibility standards, the WCAG 2.0 guidelines [22], which specify how to create accessible Web content, are considered. Moreover, the developer should consider the guidelines MWABP [23] and MWBP 1.0 [24] which are related to the creation of accessible Web page and applications in MDs.

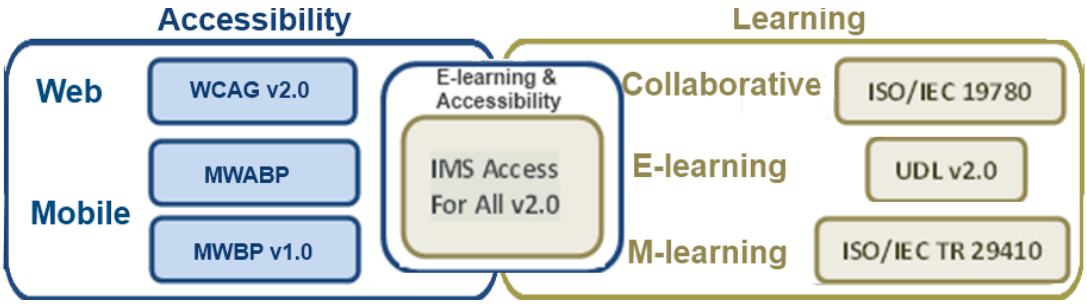

Figure 2. Standards and guidelines followed to the development of a m-CSCL.

On the other hand, a learning tool should accomplish with some standards and guidelines to be more usable and comprehensible. It has been considered the standard ISO/IEC 19780[25] to create a CSCL environment and the standard ISO/IEC TR 29410[26] for m-learning. Moreover, the guidelines UDL v2.0 [27]explains how to reduce barriers to access the learning content.

Finally, there are other specifications which are centered in the creation of CSCL and accessible tools. The IMS guideline [21] specifies some recommendations to

develop an accessible collaborative learning tool; specifically it proposes some guidelines to create a chat in an accessible way.

3.3 Requirements Elicitation for an Accessible Chat

There are many definitions of chat; however, there are not many definitions which include accessibility on it. The research work [28] defines a chat and the accessibility problems that it usually presents:

> "Text chat is a synchronous tool, which allows several users to communicate via typed text in real time."... "There are two basic issues related to accessibility of chat applications: fast-paced conversation and the need to track multiple simultaneous threads present problems for users with difficulties reading, composing, or typing under time constraints; and, confusing interfaces and inconsistent navigation can be difficult and frustrating for users with cognitive or mobility disabilities."

These barriers are mainly interaction problems that people have to face when they interact with a chat through a MD. The main objective of this paper is to elicit the requirements needed to design an accessible chat for MDs, this process is explained in the next section.

3.3.1. Requirements elicitation process

In order to solve the accessibility barriers, the requirements elicitation process consists on a User Centered Design (UCD) approach [28] to elicit the requirements needed to design an accessible chat for MDs. Taking into account it, usability techniques like User Profile technique [30] Personas technique [31] and Scenarios technique [32] have been used.

In the user modeling tasks, several user groups have been taken into account in order to analyze their necessities in an accessible chat. These groups have been defined under the consideration of common attributes among users according to their access characteristics such as chat experience, mobile experience, type of disability, etc. These common attributes which enable to model groups that have been obtained through investigation, interviews with users, etc. Once these attributes and values have been established, we have an approximation to all the users we want to reach to, and some User profiles considering common attributes (see table 1).

The personas technique has been used to categorize the users that use chats in MDs. With the personas technique groups of people that represent shared behavior

patterns, objectives and necessities. People are fictitious users, but the patterns have characteristics based on the investigation over the real audience.

Characteristic	Values
Speech disability	Yes or No
Visual disability	Blindness (B), Low vision (LV), Color Blindness (CB)
Physical disability	Motor disabilities (MD)
Hearing disability	Deafness (D), Hard of hearing (HH)
Cognitive and neural disability	No, Dyslexia and dyscalculia (DD), Attention deficit disorder (ADD), Intellectual disabilities (ID), Memory impairments (MI), Mental health disabilities (MHD), Seizure disorders (SD)
Mobile experience	Low (L), Medium (M), High (H)
Web experience	Low (L), Medium (M), High (H)
Assistive software experience	Low (L), Medium (M), High (H)
Chat experience	Low (L), Medium (M), High (H)
Age	Young Adulthood [19-49]; Middle Adulthood[40-65]; Maturity[65-end]
Sex	Female (F), Male (M)
Native speaker	Spanish(Yes), No
Place of birth	Name of the country

Table 1. User profiles considering common attributes and values

Considering common attributes of the modeled users (see table 1) some people of personas techniques are "created" to make an instance of these characteristics. These personas are represented in the table 2, which specifies the personas with their values of each attribute.

	Speech disabilities	Visual disabilities	Physical disabilities	Hearing disabilities	C. and N. disabilities	Mobile experience	Web experience	Assistive SW experience	Chat experience	Age	Sex	Native Speaker	Place of Birth
Rosa	No	No	No	No	No	H	H	No	H	21	F	Yes	Spain
Shannon	No	LV	No	No	No	L	L	No	L	22	F	No	USA
Felipe	No	No	No	HH	No	H	H	H	H	19	M	Yes	Spain
David	Yes	No	No	No	MI	L	L	No	L	41	M	Yes	Spain
Antonio	No	LV	MD	No	No	M	M	No	M	67	M	Yes	Spain

Table 2. Characteristics of created personas

And finally, Scenarios technique is used to obtain information related to how the personas created previously interact with chats in MDs. The scenarios selected are some of the main tasks that users can execute in a chat. These scenarios are: create a conversation, create a chat sentence, send a file, add interlocutor, previous conversation, select written language. Moreover, the guidelines and standards selected in section 3.2 are taking into account to design a chat that accomplishes them.

3.3.2. Requirements elicitation results

The results obtained after using the combination of User Profiles, Scenarios and Personas techniques show chat presents accessibility problems in MDs. The Appendix A shows a summary of the persona-scenarios results and this section shows a minimum example of the scenarios used to obtain the requirements for the accessible chat is explained in natural language next. Moreover, it is important to remark that this scenario mixes some of the scenarios used:

> A student, Antonio, has bought, a tactile MD, but he is not used to tactile keyboards. Moreover, he has decided to use a chat to communicate with his classmates because he has some doubts related to an exam. Antonio logs into the application chat and creates a conversation with Rosa, his colleague. So, he selected Rosa and pressed "Create a conversation". Then, Antonio writes a message and presses "Send". Rosa is much more quickly than Antonio writing messages in a tactile keyboard. As a result, Antonio is not able to follow the conversation and feels uncomfortable with it. Latter, Antonio writes a message and attaches a file. Rosa receives the image; however, she has decided previously not to show images in her MD to reduce her download limit, so she cannot see the image and understand the whole message. Moreover, Rosa is on the move so she cannot read it well and follow the conversation. Finally, Antonio decides to leave the conversation and presses "Leave conversation".

The difficulties found in this scenario are relative to: the conversation flow, the attached files and the messages format. To solve these problems, some new features, which are represented in figure 3, have been included in the requirements of an accessible chat in MDs. Next, these new features are explained and related to each problem.

1. **The conversation flow: "**Antonio cannot follow the conversation because he is not used to tactile keyboards". It means that the time that he needs to answer is

higher than usual. This problem is similar to the problems that people with motor impairments or older people, for instance, have when they try to use this kind of keyboards. To solve it IMS [21] expresses that people could be able to refresh messages manually and help people who communicate slowly. So, a new functionality to stop the auto refresh conversation is added, "Stop auto refresh conversation" in Figure 3. It consists on stopping the instant messages until the person considers it. In the previous example the situation will change as follows:

> "… Antonio writes a message and presses 'Send'. Rosa replies to it quickly. As a result, Antonio is not able to follow the conversation and feels uncomfortable with it; so he presses 'stop the auto refresh'. The system informs Rosa about it with the message 'Antonio is busy'. Rosa waits. Antonio presses 'send' message, 'Refresh conversation' and the conversation is refreshed…"

2. **The attached files:** "Rosa receives the image; however, she has decided previously not to show images in her MD to reduce her download limit, so she cannot see the image and understand the whole message". In this situation the user is not able to understand the message because she cannot access to the image. This problem is similar to the problems that people with visual impairments have to face when someone sends them an image. Basing on the guidelines [22][23][24] , it is necessary to provide alternative content to the non-textual content. Thus, the functionality "Add file" can improve it because it asks the user for an alternative content to the images uploaded just in case the other person was not able to access to the content. Then the previous example will be:

> "… Antonio writes a message and attaches a file. The system shows the message: 'Some people could not access to the file. You can provide an alternative text to the image to avoid it'. Then Antonio writes a description of the image. Finally, Rosa receives the image and an explanation of the image; so she can understand the whole message…"

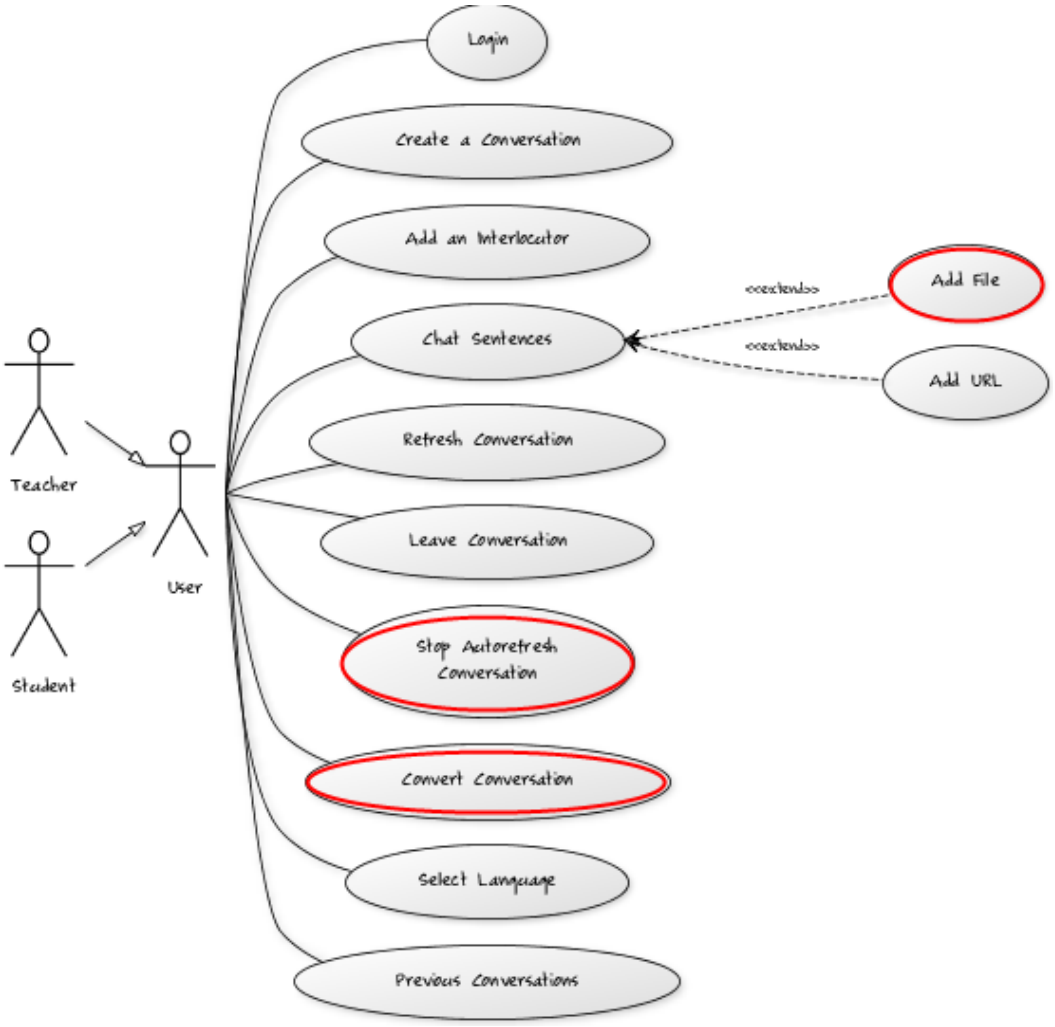

Figure 3. Chat Use Case Diagram UML

3. **The messages format:** "Rosa is on the move so she cannot read it well and follow the conversation". It means that Rosa cannot read the messages because she is moving. Visual impaired people can have the same problems because sometimes they cannot read the text because they can see the text moved, blurred or they cannot see anything. The study [9] specifies that a typical problem in chats is that they do not usually provide (text-to-speech or text-to-braille) to adapt it to his necessities and circumstances. Thus, a new functionality is added "Convert conversation" in Figure 3 which includes it. Then the previous example will be:

> "… Rosa is on the move so she decides to use the functionality 'Convert conversation' and selects 'text-to-speech'. Then, she receives voice messages…"

3.3.3. Strengths and weaknesses of the proposal

The recommendations explained previously pretend to solve the problems of interaction found after applying the User Profiles Personas and Scenario techniques. Our proposal considers user experience and real-time as essential factors; as a result, some recommendations are proposed to design an accessible chat for MDs. The flow of the conversation could be stopped and users with problems to follow it would be able to understand the whole conversation; Moreover, alternatives to the content sent should be provided in order to follow the conversation properly. And finally, the information should be showed in different ways to adapt it to the user's necessities.

Taking into account these situations and the recommendations provided, the users could communicate with each other through a chat and the problems of interaction can be minimized. These recommendations improve the user experience especially for users who cannot follow the rhythm of the conversation because they can communicate with each other in the way that they chose. For instance, if they consider that they cannot write fluently then they can stop the conversation until they want. Also, if they cannot write on the MD then the user can communicate using other format like text-to-speech. Moreover, people who cannot see the files sent through MDs can understand the whole message because they can read an explanation of the image.

However, it is important to remark that these approximations could not be the whole requirements that an accessible chat should have. Currently, the research group is capturing the whole requirements needed to create an accessible chat for MDs; so, it is a preliminary study which captures some of the requirements needed to create an accessible chat in MDs. This means, that the complete study should consider real users and experts to evaluate the requirements elicited.

4. Conclusions and future work

Many people have to face with different accessibility problems when use a chat in MDs. These accessibility problems are not faced only by people with disabilities, but it also depends on the context of use of the tools, as the scenario in section 3 shows. To solve them, this study elicits the requirements needed to design an accessible chat in MDs for everybody following the UCD approach. Besides, it proposes solutions to the problems: the flow of the conversation; impossibility of access to files sent; and the messages format. As a result, the accessibility barriers of chats can be removed and the user experience would be improved. Moreover, people could get a profit of it in m-CSCL

because they could learn while they are collaborating with each other without any barrier and wherever they want.

In future trends, an implementation of this approach is taking to end, with the aim of validating the solutions proposed to solve the accessibility problems founded. Besides, this implementation is being validated by users and by experts using heuristical techniques.

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Appendix A. Scenario Results

The results obtained after the use of the scenario usability technique shows some accessibility problems. These accessibility problems are presented in table 3 which is divided into six different columns. The first column represents the different scenarios in which each persona (column 2) executed the task of this scenario. After that, some accessibility problems are detected by the personas in each scenario (column 3). Moreover, the column 4 represents the guidelines followed for each scenario. Each guideline is categorized by a code which is represented by Guideline_version_code_type. The guideline can be: WCAG, if it is from W3C WCAG guidelines [22]; MWBP, if it is from W3C guidelines [23][24]; UDL, if it is from [25]; ISO, if it is from ISO 29140 [26] or IMS , if it is from IMS [21]. Besides adding to the guideline code, the type of the guideline is added: IR if it is an interaction guideline and CR if it is a content guideline. Our proposal explains some solutions to transform each task into an accessible task for everybody (column 5). Finally, the column 6 shows the people who get a profit of the proposed solutions.

Scenario	Persona	Problem	Guidelines	Solution	People who get a profit
Create Conversation	Antonio	Antonio is not able to distinguish if Rosa is connected or not because it is used the color green to show if she is connected or not	WCAG_2.0_2.2.1_IR, WCAG_2.0_2.2.1_IR, WCAG_2.0_1.1.1_CR, MWBP_1.0_36_CR, UDL_2.0_1.3_CR	Users could stop the autorefresh of the users that are logged in the application. Chat users are divided into three different categories: connected, idle or disconnected. Moreover, these categories are separated without use colors or shapes	Visual impairments Interact with the MD in sunny places
Chat sentences and Add File	Rosa	Rosa is not able to see the image because she cannot download it; she has reached the limit connection.	WCAG_2.0_1.1.1_CR, MWBP_1.0_36_CR, UDL_2.0_1.3_CR, MWBP_1.0_25_CR	Guide the user to provide alternative content for the users that cannot access to all the sent content. Inform both users about the weight of the image.	People with visual impairments. Small screens
Chat sentences	Antonio	Antonio is not able to follow the rhythm of the conversation and feels really uncomfortable	WCAG_2.0_2.2.1_IR, WCAG_2.0_2.2.2_IR, MWBP_1.0_14_IR, IMS_v2_5_IR, IMS_v2_6_IR, IMS_v2_7_IR,	The user could stop the autorefresh of the conversation whenever s/he wants. Even if the user stops the flow of the conversation,	People with motor disabilities. Mobile, web and chat experience.

Scenario	Persona	Problem	Guidelines	Solution	People who get a profit
		because of this.	WCAG_2.0_1.3.2_CR, WCAG_2.0_1.3.1_CR	the user should be able to read the conversation in the real sequence.	People with learning problems. Foreign people
Add interlocutor	Antonio	Unable to distinguish which users are connected or not. The user is not able to follow the rhythm of the conversation	WCAG_2.0_2.2.1_IR, WCAG_2.0_2.2.2_IR, MWBP_1.0_14_IR, IMS_v2_5_IR, IMS_v2_6_IR, IMS_v2_7_IR, WCAG_2.0_1.1.1_CR, MWBP_1.0_36_CR, UDL_2.0_1.3_CR, WCAG_2.0_1.3.1_CR, WCAG_2.0_1.3.2_CR	All users should have the possibility to stop the addition of an interlocutor. The user should be able to stop the autorefresh of the users that are connected or not to the application The conversation could be stopped by the user whenever s/he wants. Chat users are divided into three different categories: connected, idle or disconnected. Each one of these categories are separated without use colors or shapes The messages should be sent in the real sequence.	People with visual impairments People who interact with the MD in sunny places People with motor disabilities. Mobile, Web and chat experience. People with learning problems. Foreign people
Previous conversations	Rosa	N/A	ISO_29140_2_6.2.3_CR, ISO_29140_2_6.3.2_CR	N/A	N/A
Written Language	Rosa	N/A	ISO_29140_2_6.2.6_CR	N/A	N/A

Table 3. Accessibility problems detected after the use of Scenario usability technique.