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TOWARDS AN ACCESSIBLE SCIENCE: FACILITATING ACCESS TO SCIENTIFIC DIGITAL RESOURCES FOR VISUALLY IMPAIRED STUDENTS

D5.1 Implementation of the communication network

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Executive Summary

This deliverable concerns the @Science communication and collaboration infrastructure, which is developed in the Work Package 5: Shared information network and devoted knowledge bases. This infrastructure underlies many of the project activities therefore it was set in the early stages of the project. The target group of visually impaired users was taken into account in the development of the communication and collaboration tools and in designing the strategies to contact and inform about the ongoing activities.

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1 INTRODUCTION

1.1 Scope of the document

This document illustrates the objectives of the @Science communication network and presents in-depth the choices taken with respect to the target groups and how they were implemented. The communication network is a vital functional component to achieve the project aims. Therefore, its performance will be monitored during the coming stages of the project and further extensions or modifications will be designed if needed.

1.2 Communication network overview

One of the aims of the @Science thematic network is the creation of a community interested in science accessibility by visually impaired people. This emerging community is supposed to share individual experiences in learning science through assistive technologies, to discuss about existing practices to teach science and technology related subjects to visually impaired students especially at university, to exchange information about learning opportunities of specific assistive tools, to inform about @Science resources and eventually to collaborate in going towards transnational solutions to facilitate visually impaired students to access scientific studies at university. The core of the @Science community will be a set of distance collaboration tools. Also live meetings will be organized (e.g. the @Science international conferences planned in the Description of Work, see Table 7.6), but distance collaboration will be preferred. Actually, although such a community may get advantage from live meetings where experiences can be shared, some considerations account for the employment above all of distance collaboration strategies to support the @Science collaboration group:

- the need to ask for resources and to search about solutions and experiences to facilitate the access to science to visually impaired generally arises in particular situations involving individuals and institutions. For example, when a visually impaired student wants to go through university studies, the choice of the right course is often affected by analogous experiences, by the availability of educational resources accessible through assistive technologies, by the possibility to successfully attend the courses and by the awareness of institutions in dealing with special needs. Therefore, it is important to provide a collaboration infrastructure able to give answers about the opportunities in science learning whenever it is necessary, not only in particular occasions as live meetings or conferences do. Live events have a transient nature. Indeed, even if proceedings are published and the speeches are recorded, interaction (e.g. question and answer sessions, discussions, etc.) is almost totally lost after the event. That does not happen with those distance collaboration tools which allow to record interactions and to establish a community with experienced members;
- live events are bound to the place and to specific time slots. That doesn't encourage participation, especially in the case of the target group of visually impaired people who have generally difficulties to reach the place where the event is held;

- certain distance communication tools are mainly based on written communication, which is not often used in live events. Written communication presents some advantages. For example, by writing, many persons overcome their personal attitude not to speak within a large group of persons; the problem can be stated with details and also with excerpts, sample code, tables, etc.; references can be more accurate (e.g. web site references, paper references, etc.) and the difficulties due to multilingual communication can be overcome either through an intermediary who translates the messages or by jotting down messages not totally correct, but which can be understood. Nonetheless, also speech communication is important. Therefore, it has to be guaranteed by the communication infrastructure;
- live presentations may be little accessible by the visually impaired audience. Live presentations usually employ slides without a proper description by speech. Furthermore, an often under weighted problem concerns the English speaking. Even if English is understood by many people, the meaning is often gotten mainly by looking at the lips of the speaker and by gestures. That is difficult or impossible for visually impaired people.

The following sections will present the distance communication tools which were analyzed to build up the communication network. Subsequently, the structure and tools of the @Science communication network are presented.

2 DISTANCE COMUNICATION TOOLS

This section introduces the distance communication and collaboration tools which have been taken into account up to now for the @Science communication network. Each tool was assessed with respect to the target group, namely visually impaired students, tutors, teachers and university professors. Therefore, three main specificities led the choice of those tools to be integrated in the collaboration network: usability and accessibility features, the familiarity with the communication tools, namely their use in daily circumstances not necessarily bound to the purposes of the @Science network and the possibility to maintain the communication and collaboration network after the end of the project, namely the need to employ tools which are free or affordable for routine expenses and easy to be updated, extended and adapted to special needs. Easy maintenance and extensibility can be achieved especially through open source programs.

2.1 Forum

Basically, a forum is a website composed of a number of topics written by the forum members. A set of related topics (e.g. all of the replies to the first message) constitute a thread. So, each thread entails a discussion in the form of a series of member-written posts. These threads remain saved on the forum website for future reading indefinitely or until deletion by a moderator. However, forum software can be considerably more advanced. Most forum software allow more than one forum to be created. These forums are containers for threads started by the community. Depending on the permissions of community members as defined by the board's administrator, they can post replies to existing threads and start new threads as they wish. Forum software can be broadly divided between those which allow visitors to post anonymously,
and those which allow posts once registered by specifying a username and a valid e-mail address. The former sort of forum can generally be highly customized, in particular as for the user profile and how the messages should be displayed (e.g. sorted alphabetically, by date, by sender, etc.). Threads in a forum are either flat (posts are listed in chronological order) or threaded (each post is made in reply to a parent post). Most of the forum software packages widely available on the Internet are open source and they are written in programming languages (e.g. PHP) which allow easy integration with other Internet tools (e.g. with Content Management Systems, mailing lists, etc.). Each package offers a different variety of features, from the most basic providing text-only postings to more advanced packages offering multimedia support and formatting code (usually known as BBCode). The forum guarantees asynchronous distance written communication among members of a community. It can be used without installing client-side programs other than one of the most known Internet browsers. That prevents people from performing complex and time-consuming configurations, thus fostering also those who have not technological skills, to participate to the discussions. Forums are generally made up of static pages. As a consequence, accessibility through speech and Braille assistive technologies can be easily guaranteed. Nonetheless, some accessibility problems can arise when some basic design rules are not employed. First of all, the forum should be validated according to the Web Content Accessibility Guidelines [1]. Then, threads should be easy to be found (e.g. through a table of contents or a search functionality). That eenables screen readers users to easily find the information needed and to contribute with topics or replies in the right area. If the research of the right forum section to post messages takes a long

time, forum members will be soon discouraged to take part to the discussions. Another accessibility issue which has to be dealt with in a forum concerns what is allowed to be posted by the forum members. Even if the forum structure was designed according to the web accessibility guidelines, the forum members are often not aware of accessibility issues. Therefore, only some tags should be allowed in posts. For example, if images are allowed to be posted in a message, if they are not related to an alternate text description, they will convey information totally not accessible through speech and braille technologies. Also, if HTML tags deprecated by W3C authorities, are allowed, the resulting forum posts can get hardly accessible in some circumstances.

2.2 Mailing list

A mailing list on Internet refers to a special usage of e-mail that allows for widespread distribution of information to many Internet users. Mailing lists can be divided in: public and private. Public mailing list can be accessed without subscription, whereas private ones need a subscription to send or receive e-mail messages. A mailing list can be moderated or not. Messages posted to a moderated mailing list are not delivered before the approval by the mailing list moderator. Mailing lists are generally used to discuss about a specific topic. In order to get involved in a mailing list, only an e-mail client is needed. All of the interactions, including subscription or un-subscription, can be achieved by sending o receiving e-mail messages. All of the e-mail messages sent to the mailing list address are received by all of the subscribed members. So, every e-mail client will record whatever message comes from the mailing list. This is regarded as a useful feature by many users. For example, blind users can set properly their e-mail client program and then they can perform easily advanced searches among e-mail conversations. Anyway, especially when mailing lists deliver many messages a day, disk space and download time may become critical factors. In order to reduce the problems coming from the lack of disk space or from high download time, digest delivery of e-mail messages can be made available. Digest delivery allows for distribution of e-mail messages containing the subject of the e-mail sent to the mailing list during a certain time slot. This delivery modality can be very useful also to visually impaired people because summarized information delivered through one digest e-mail allows for time saving to find topics of interest when browsing through speech or braille devices. In the end, mailing lists are highly accessible by visually impaired users, because all of the accessibility problems are demanded to the e-mail clients, which can be highly customized and some of the e-mail delivery modalities are particularly suitable for visually impaired.

2.3 Wiki

A wiki is a website that allows visitors to add, remove and edit content, typically without the need for registration [1]. It also allows for linking among any number of pages. This ease of interaction and operation makes a wiki an effective tool for distance collaborative authoring. Wiki present the accessibility issues discussed for forums. Moreover, one more accessibility issue for visually impaired users arises in dealing with wiki. The editing functionalities made available by the wiki software should be totally accessible. This is not often true because mainstream screen readers hardly handle many operations in the editing area. Furthermore, tracking all of the changes made by users can be hardly achieved by visually impaired because many connected informational units are displayed on the page.

2.4 On line chat

Online chat refers to a many to many text-based communication system on the web. A chat system is characterized by synchronous communication among the participants to the chatrooms. There are many chat systems, in particular: client-side chat systems and server-based chat services. Both of these systems present relevant accessibility issues for visually impaired users. The main problem is concerned with the synchronous nature of chat communication. By using speech and Braille output is not straightforward to get an overall glance at the information displayed [2]. Especially, auditory or tactile cues are needed to allow for auditive and tactile understanding of complex information. Indeed, synchronous communication quickly lead to the presentation of complex information. There are many events which need to be communicated real-time in a non-visual way: new messages received, the sender of a certain message, the message, the chat members entering or leaving the chat room, the position of the editing area to write in, application warnings and so on. Some chat systems were adapted to be used by visually impaired, but they are still not totally usable, especially when the number of chat members is high. Furthermore, recent chat systems are implemented by using AJAX technologies [3]. AJAX technologies are still not totally supported by mainstream screen readers [4] and accessibility guidelines about dynamic interaction in web pages are not still widespread [5].

2.5 Instant messaging

Instant messaging is a communication system based on one to one exchange of written messages. Communication is synchronous and text messages can often be enriched with multimedial content, such as audio and emotions. Most instant messaging services are embedded in a website and they offer a presence information feature, indicating whether people on one's list of contacts are currently online and available for messaging. Accessibility issues concerning instant messaging systems are very near to those presented for chat systems. However, even if communication is synchronous, since it is one to one, the number of events to be communicated in a non-visual way is low. Therefore, instant messaging systems can be more accessible by visually impaired than chat systems.

2.6 Peer-to-peer VoIP programs

Peer-to-peer VoIP programs (e.g. Skype, Yahoo Messenger, Microsoft Messenger) allow for speech communication between people through Internet. In order to use most of these programs, registration is needed. These programs usually have many features including: a list of contacts, a chat system, file transfer, webcam connection, recording of the conversation, and so on. Accessibility issues are related to the user interface designed for these programs. They are generally highly accessible. Furthermore, thanks to the scripting languages provided with many of the mainstream screen readers, they can be customized to achieve higher accessibility.

2.7 Audio conference systems

At present, there are many applications which enable a group of people to take part to or organize an audio conference. Some of the widespread Voice over IP programs usually embed features to

support small audio conferences (e.g. up to five participants). When a great number of participants is expected, many other programs are available. These programs have an accessibility level depending on their user interface. For example, some of them are Macromedia Flash applications, developed without taking into account any accessibility guideline. One commercial program known as tcConference (see www.talkingcommunities.com) was experimented. It has been used for more than one year by the American Hadley School for the Blind (see www.hadley-school.org) for audio conferences involving blind people all over the world. This program allows for organizing audio conferences, to interact with a microphone and to communicate through a text chat. A high number of key combinations ensures high accessibility and usability.

3 THE @SCIENCE COMUNICATION NETWORK

3.1 Introduction

Communication and collaboration are key factors for the success of the @Science thematic network. Communication and collaboration are meant along many directions:

- towards founding network members, namely inside the @Science consortium which leads the network activities;

- towards institutions who will be involved in the @Science network during the project lifetime;

- towards individuals who are already interested in the project activities and are contributing (e.g. the individuals who have an account on the website and send proposals of articles to be uploaded and made available);

- towards potentially interested people who are not yet involved (e.g. those who browse the website as anonymous guests).

In order to encourage communication and collaboration, a set of devoted tools was prepared. These tools are now available to be used. All of the communication and collaboration strategies rely on distance interaction. As mentioned in the first section, this interaction modality was regarded as the most suitable one for the @Science context. Anyway, all of the network activities will not be bound only to distance interaction (see @Science Description of Work, Work package 6).

The following sections will introduce the communication and collaboration tools which will be used by the @Science network with respect to the target group and to the expected goals. Since the @Science website is supposed to be the core of the network, all of these tools are either integrated in the website or strongly related to it. The choices were led by the preliminary study presented in section 2.

3.2 The mailing list for the @science founding members

First of all, communication and collaboration should be viable among network founding members. That is indispensable to exchange ideas about the future network development, about the criteria to employ for defining the best practices and the guidelines, to cooperate in preparing the deliverables and the papers for conferences or the articles for the website, and so on. To this purpose the consortium-ascience mailing list was opened. It is moderated by the network co-ordinator. Each institution belonging to the network consortium proposes the persons to be added to the mailing list who will collaborate to the @Science activities and they will be subscribed by the co-ordinator. The main features are:

- only text messages are accepted by the mailing list. HTML messages are automatically converted to plain text. That aims to avoid potentially not accessible messages;

- file attachment are allowed. That is necessary to ensure an easy exchange of examples, work in progress drafts, and so on;

- digest mode is not available. It is important that all the members of the mailing list read all the messages so that every member is aware of the ongoing activities.

3.3 The @science forum

The forum can be a suitable place to start discussions, to look for help about some issues, to give answers and to exchange experiences. Therefore, a forum was integrated in the @Science web portal. At this stage, the forum aims to deal with every topic concerning science accessibility by visually impaired people without any further restriction. The forum can be found in the website. It can be easily reached once authenticated and the latest posts are displayed in the homepage. Only authenticated users are allowed to post replies to messages posted in the forum or to start new forum threads. For safety reasons, each message posted to the forum needs the approval of the moderator to be published. However, anonymous users can read the posts and search engines can index the forum threads thus providing a resource of information also outside the website. The forum aims to reach those users of the website who are authenticated, hence who have already decided to get involved in the @Science network. It also tries to reach potentially interested anonymous users who browse the website for the first time or who are just looking for a specific answer. The network founding members and experienced people suggested by the network members will take part to the forum and will be ready to provide information and to post new topics potentially interesting and useful for the target group. English is the language of the forum. It was supposed that the target group should be skilful enough in writing and reading English. If requests come from potentially interested users about forums in national languages, they will be discussed by the network members and new forums could be opened.

3.4 The thematic forums

The @Science is the kick-off forum. If many participants propose strongly related topics (e.g. about particular learning subjects or about a specific application or method), new forums will be opened. These new thematic forums will address a specific issue. They will be opened to all of the authenticated users. Anyway, single forum and cross-forum search capabilities will be added to the website so that the selection of topics to be dealt with in thematic forums will not lead to fragmentation of available informational resources, rather than facilitate discussions.

3.5 The @Science mailing list

In section 2.2 was remarked that visually impaired people are very acquainted with electronic mailing lists, both because accessibility problems are demanded to the e-mail clients which can be easily customized and then because some exploration modalities are suitable for non-visual reading. Therefore, a mailing list for registered @Science members was set up. The @Science mailing list means to encourage discussions about every topic of science accessibility by visually impaired people. The target group involves people interested to discuss about science accessibility, who may not be interested in collaborating on the website or who prefer this communication form (e.g. many blind students). The mailing list might be redundant because a forum is already available. Nonetheless, having taken into account the peculiarities of the target group, it was regarded as a useful tool in this stage of the project. It is possible to subscribe to this mailing list from the website. Subscription is not bound to the creation of a new account on the website. That enables those users who are only interested in participating to the @Science discussions through the mailing list not to necessarily have an account on the website. The main features are:

- the mailing list is moderated. Therefore the messages need the approval by the moderator before being delivered and the moderator can suspend or unsubscribe mailing list members if needed;

- only text messages are accepted by the mailing list. HTML messages are automatically converted to plain text. That aims to avoid potentially not accessible messages;

- file attachment is not allowed. That is necessary to prevent computer safety problems and to avoid the risk to exclude people who have low bandwidth because of the download of many high size messages;

- digest mode is available. It is very useful for many visually impaired persons (see section 2.2);

- the archive of the messages sent to the mailing list is published on the @Science website. The archive can be accessed both by authenticated users and by anonymous users. That enables website visitors to find potentially interesting and useful conversations about topics they are looking for thus subscribing to the mailing list if further interested.

3.6 Wiki

At present a wiki was not integrated in the website. By the time collaboration through the forum is regarded as a good starting point. Whether users will ask for cooperative authoring, a wiki will be integrated. Nonetheless, this tool can not be used so straightforwardly by visually impaired users as analyzed in section 2.4.

3.7 Instant messaging ad chat systems

By the time, no online instant message or chat system was integrated with the website, especially because these systems are found not particularly accessible by visually impaired users. Anyway, the website was designed to be quickly extended with an online instant messaging module or a PHP accessible chat. If the users will ask for such a service, it will be integrated in the future.

3.8 Communication and collaborations through VoIP programs

Even if speech communication can be difficult because of language differences, it is crucial in some circumstances. Especially when detailed issues have to be discussed, speech communication together with one to one text chat and file transfer are proven to guarantee excellent interaction. That can be achieved through VoIP programs such as Skype, Yahoo Messenger, Microsoft Messenger, etc. Therefore, it was regarded as important to facilitate those users who wish to communicate through VoIP programs. To this purpose, the following technique was designed. When a user creates an account on the website, among the contact field, also those about a VoIP program contact are available. So, for example, if a user has a Skype contact, it can be written in the field for Skype contact when creating the account on the @Science website. This contact information will be added to the user profile. When another authenticated user wants to contact someone through a certain VoIP program, the corresponding contact reference can be found in the user profile. A "Who's online" service is available on the website so that it's easier to find when someone can be contacted. Higher integration with mainstream VoIP programs can be provided in the future stages of the project if this interaction modality will be highly appreciated by the users.

3.9 Audio conference

Audio conferences can be a useful way to present results to a wide public without problems coming from moving to the right location. As mentioned in section 2.7, tcConference software was assessed. Anyway, the most suitable software solution will be chosen when an audio conference will be scheduled by the network. Audio conferences could be proposed in the second year of the

project, especially if some target groups (e.g. students who attend secondary schools and have to decide university courses) can't participate to the @Science live conferences (see Description of Work Table 7.6).

3.10 The @Science newsletter

Communication has to be guaranteed also towards a broad public not necessarily highly involved in the network activities, but potentially interested in some specific activities (e.g. conferences about a certain subject) or resources (e.g. a certain demo application). To this purpose, a newsletter delivery was planned. Whoever interested to receive a newsletter by e-mail, can subscribe to the newsletter service from the website. No account is needed so that everyone potentially interested can get advantage of the information sent by the newsletter. The newsletter will be sent monthly. When some particular event is scheduled or some very relevant resource is uploaded, a special edition of the newsletter will be delivered. Each newsletter will be made up of a short description of the new resources uploaded on the website or events attended and references to the right website section where they can be found.

4 IMPLEMENTATION

All of the tools discussed in the previous section were implemented in the website. The modules extending the Drupal CMS [6] employed to manage the website were used and adapted to the specific context and target group. All of the modules are open source and based on PHP server-side interaction. Client-side routines were used occasionally so unforeseen problems can be managed better by server-side applications. Extensibility and easy maintenance are guaranteed by the open source nature of the routines and also by a wide community of developers for Drupal modules.

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